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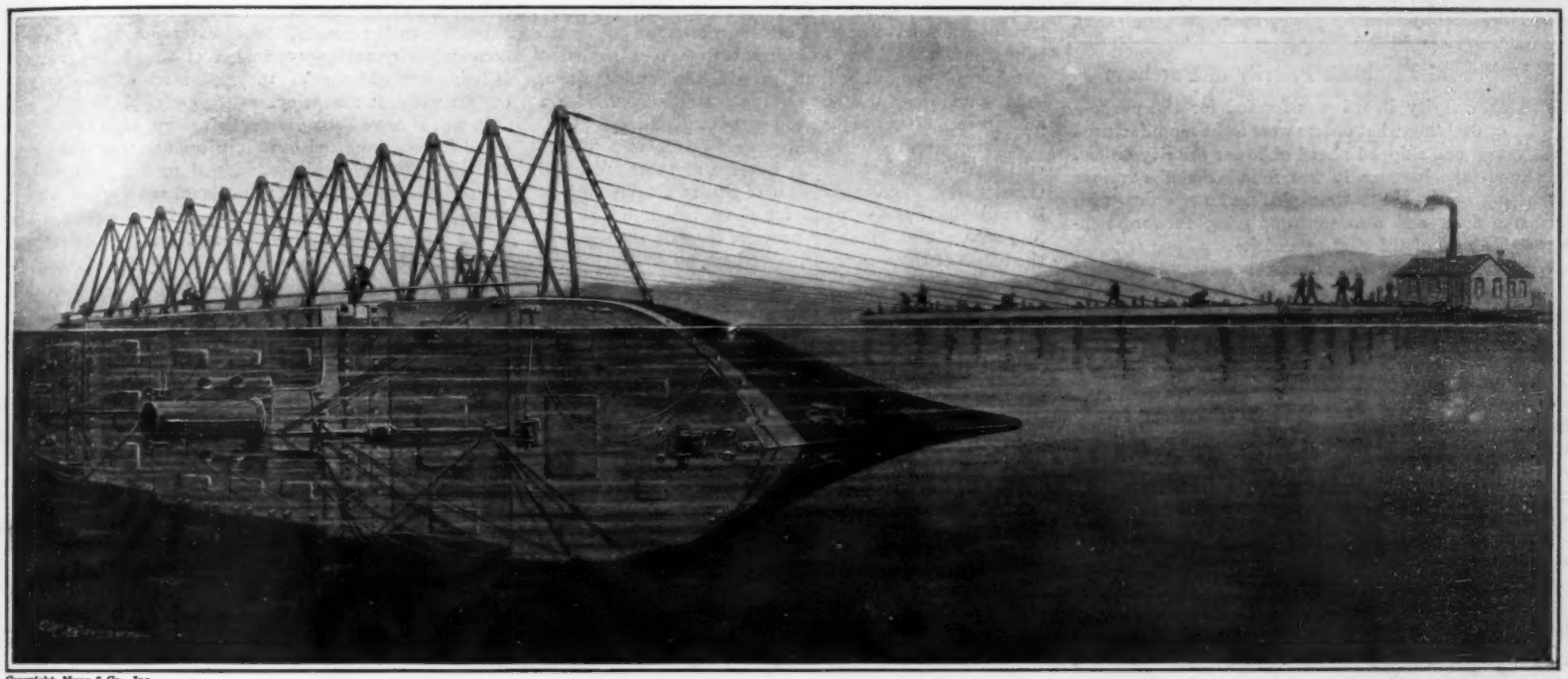

By means of a row of iron horses mounted on the upper side of a sunken steamer, and a battery of powerful hydraulic jacks, a successful salvaging operation was realized by this application of the lever principle

How the Lever Principle was Applied in Righting a Sunken Steamer

THE present scarcity of ocean bottoms has given an impetus to salvaging operations. Many a sunken ship which in pre-war days would have been allowed to rust and fall apart because of the expense and trouble involved in refloating it, now receives due consideration and in most cases is raised and repaired and re-equipped for service. For one thing, expense is no longer a paramount consideration, so urgent is the demand for ships. And the salvagers are given complete freedom in applying their ingenuity which in the present emergency has been made doubly or trebly keen.

So it follows that interesting and difficult salvaging operations are the order of the day. We may expect many interesting cases along these lines.

When the Germans captured Antwerp in October, 1914, the British left the captors a scuttled ship—the North German Lloyd steamer "Gneisenau" of some 9,000 tons. Caught by the current of the river Scheldt, the steamer had grounded on its starboard side in a position parallel with the stream. And since the Scheldt at this point has a depth of 33 feet and the beam of the scuttled ship is 55 feet, at low tide a goodly portion of the larboard side showed above the surface.

Now the Germans are just as anxious to increase their tonnage as the other belligerents, not so much for the present but rather for the future when the seas once more will be unlocked to them. So a German firm was charged in 1915 with the task of salvaging the "Gneisenau," and this is how they proceeded:

A preliminary study of the conditions convinced the German engineers that the steamer would have to be returned to the normal upright position without deepening the river bed; for to deepen the waterway would only render more difficult the pumping out of the hull. Hence it was decided at first to mount a large number of wooden horses on the boat, fastened in some suitable manner to the larboard or uppermost side. To the top of each horse was to be attached a cable leading to suitable power plants on shore, so that by the leverage of the wooden horses and the applied power it would be possible to turn the ship to its normal position. In order better to apply the power, a row of piles was driven into the river bed, giving a rigid point for the application of the power and carrying suitable pulleys for handling the cables.

Work was begun in June, 1916, and it was decided then to replace the wooden horses with similar structures of iron. So 12 horses of iron were arranged and rigidly fastened to the larboard side of the vessel in the form of a skeleton wall. Instead of using an elaborate system of tackles for the transmission of constant power, the engineers resorted to a simple power transmission arrangement making use of a battery of hydraulic jacks. Also there was a modification of the plans in the matter of the row of piles; in the final form this feature was a straight line of piles rigidly held in place in the river bottom so as to offer a non-movable point for the cables. It was estimated that the arrangement could exert a horizontal tractional effort of 3,300 tons.

But in driving the row of piles the engineers encountered the very trouble they had anticipated; namely, the river bottom was of a muddy nature and therefore could not hold the piles in place against the pull which was to be applied when righting the vessel. This predicament was soon got out of, however, by applying broken stone about the piles, stiffening the river bed in the immediate vicinity.

Everything being now ready, compressed air was next fed into the compartments of the steamers, which had previously been made airtight. The buoyancy of the air caused the vessel to rise slightly, while at the same time the pressure served to drive out some of the slime of the river bed which had made its way into the hull.

Then the hydraulic jacks were brought into play, all the while maintaining the supply of compressed air to the compartments in the hull. There were 12 jacks in the battery, each exerting a tractional effort of 275 tons on the steel frames of the ship. Slowly but surely the steamer rolled over, bringing to view the previously submerged part of the hull which in two years of rest on the river bottom had accumulated a mass of mud and a covering of seaweed. During these operations the engineers were confronted with the problem of meeting huge cakes of ice which threatened their equipment, for the work had been carried far into the winter of that year. The steamer was still listing some ten degrees from its normal position, and, needless to say, was still in a rather precarious state. But the ice was safely handled and the work came through without loss.

Then the steamer was tightly sealed by closing every opening in the hull and superstructure, and powerful pumps were set to work emptying the "Gneisenau" which by now had been pulled over to the row of piles and moored in place. Soon the steamer was floating at high tide. The hydraulic jacks were again brought into action, this time to pull the vessel nearer shore; and when the normal equilibrium was assured, the iron horses, which had been permitted to remain in place in order to act as a counterweight to the mass of mud and seaweed on the other side of the hull, were removed.

After which the steamer was towed by tugs to a shipyard, there to be repaired and repainted and refitted for eventual service on the high seas.

Convenience for Microscopic Workers

A NEW binocular magnifier will enable medical men, geologists, botanists and others called upon to make minute examinations of objects with a low magnification, to enjoy the advantage of the use of both eyes simultaneously, thus improving the general definition and enabling the observer to view the object in relief with natural perspective. With the older form of binocular magnifiers, this very condition was lost sight of and consequently the depth of definition and true perspective are largely impaired with these constructions. To overcome this there have been arranged two rhombohedric prisms in order to reduce the distance between the optical axes on the object side of the prism so that both fields of view appear within comparatively small convergent angles. The magnifier is held in place by an adjustable elastic headband or a fiber one if preferred.

The eyepiece caps are of hard rubber, shaped to fit snugly over the edges of the orbit but allowing sufficient space for the insertion of corrective glasses if required for astigmatic eyes. Provision is made for ventilation to prevent the accumulation of moisture upon the surfaces of the lens and in addition to this there are apertures in the lower part of each eyepiece through which the observer may locate and pick up tools or instruments being made use of. For the examination of deep cavities or dark, uneven specimens, an illuminating appliance may be fitted to the binocular magnifier.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

We Should Establish Priority of Purchase

THE Priority Board was formed for the purpose of deciding what orders were to be manufactured first and shipped ahead of lower priority orders. This was done because it was found that the various purchasing departments were placing large orders with the same firms and also were ordering forward non-essentials ahead of the vital necessities.

For the same reason is it not now necessary to appoint a Priority Purchase Board so that nothing may be ordered which cannot be shipped to France in time to arrive there before the need has been otherwise filled.

When one reads the statements of the Senate Military Committee questioning the ability of our ships to transport and supply our Army in France, and then reads of the millions of shells, thousands of heavy artillery guns, tens of thousands of airplanes, thousands of motor trucks, railroad equipment, horse and mule transport, dock machinery, equipment for repair shops, shell-refilling plants, and the million little things that add up to a huge total, one questions whether there has not been enough already ordered to fill our ships for two years to come.

Would not a Priority Purchase Board, informed by the Shipping Board of the probable amount of shipping space that will be available for six months in advance, and working in conjunction with the Priority Order Board and the Purchasing Department, save this country tens of millions of dollars which are now wasted in tying up manufacturers on useless work? Even more important than this is the waste of great quantities of raw material. The large tonnage of material ordered by the Allies in the early stages of the war and now lying in the vicinity of every large port in this country because of the lack of ships, has caused unnecessary congestion and loss of material by weathering; and a great deal has actually become obsolete or no longer required. We should profit by the costly experience of others, rather than purchase this experience anew on our own account.

Build Them to the Limit

AMONG the various craft that have been engaged in fighting the submarine, there is one, the destroyer, which stands out as supreme in its all-around efficiency; and, were it not for the limitations of time imposed and the impossibility of finding the ways on which to build them, it would be good policy to lay down half a thousand of these boats at once. But the very elements of size and power which make the destroyer so efficient, absolutely prevent its being constructed in any such numbers.

The development of new devices for fighting and destroying the submarine has been so rapid, and these devices are of such special characteristics, that it is no longer necessary to build vessels of a thousand tons or more (which is the size of the latest destroyers) in order to carry these devices and employ them to the full limit of their efficiency. Listeners and depth bombs can be used as effectively on a 500-ton boat as they can on a 1,000-ton destroyer, and the smaller boat can be turned out for one-third the cost and in one-third the time of the larger.

It is well known that the Navy Department has in hand at present a large destroyer program. Also, a number of small destroyers or large submarine chasers, as they might be called, of five hundred tons displacement are being built by Henry Ford. It is stated that the total contract is for one hundred. That is progress in the right direction, and Mr. Daniels, the Secretary of the Navy, is to be congratulated upon his quick appreciation of the problem and the generous scale upon which he is pushing through the enlargement of our destroyer fleet. But, in spite of what is being done, we feel that our efforts should be redoubled, particularly in the class of large submarine chasers. It would be desirable to put in hand at once not less than two hundred and fifty additional boats of this size, and we understand that the Secretary, who has shown during this war, a very quick appreciation of naval situations and naval requirements, is in favor of the construction of a large additional fleet.

We have made it a point to look into the matter of the facilities of the country for building another two or three hundred 500-ton craft without interfering with existing naval construction, and we are much gratified to find that the additional boats can be built—hulls, engines, boilers and fittings—without interference with previous contracts. We found that several of the engineers and manufacturers in the country have laid their heads together, with the result that a design, which appears to be more seaworthy and considerably faster than the one which is being built by Henry Ford, has been drafted, and various firms stand ready to put their whole energy into their construction, with a promise to have an additional two hundred and fifty boats at the service of the Navy within twelve months time.

The situation in the submarine warfare today is this: that our scientists and engineers, as a result of patient investigation, have devised certain means for killing the submarine, which are so efficient that, if a sufficient number of boats can be found on which to emplace them, submarine piracy will be practically snuffed out within a few weeks after the fleet of boats is in commission.

Judging from the hostility aroused by the recent criticism of the battle-cruiser design of the Bureaus of Construction and Repair, and of Steam Engineering, it is probable that the plans for these two hundred and fifty submarines will also provoke hostile criticism at the hands of these Bureaus. We have no doubt that the Secretary of the Navy is well aware of this tendency, and the country at large will look to him to see that there is earnest and patriotic coöperation in this matter between The Staff Officers of his Department and these civilian naval architects and engineers who stand ready to assist the United States Navy in its fight against the U-boat.

Quantity-Production of Airplanes

WHEN the Aircraft Production Board set out to translate its appropriation of $640,000,000. into airplanes in the shortest possible time, the Board believed that the surest way to secure the desired result, particularly as regards large and speedy output, was to apply to the highly-specialized art of airplane construction those quantity-production methods which have been so successful in the automobile industry.

It took no little faith and courage, particularly in view of the great world crisis to which our aircraft program was so intimately related, to commit the nation to what was essentially a great industrial experiment; for no one of the allied nations, so far as we are aware, had pledged itself to a single type of motor, the component parts of which were to be built in quantities at widely separated centers, and brought together for assembly and erection into the finished motor.

For it is a fact that the experience of the European builders had shown that the best results were obtained when the whole motor was constructed by a single firm, utilizing a force of operators which had been specially trained to work to the very exacting requirements as to materials and finished measurements.

Naturally, when thinking in terms of quantity-production, the Aircraft Board turned its attention to our huge automobile and allied industries; and the question to be debated was whether it would be possible to combine with quantity the high quality which was necessary, a quality far in excess of that which is called for in the construction of automobile motors. It was resolved to put the matter to the test. A well known type of American automobile motor was taken as the basis of the new design, and it was modified so as to include the best features of French, British and Italian practice. The result was the Liberty Motor.

Now, everybody is aware by this time that the hopes of the Aircraft Production Board have not been realized. Although the Liberty motor, when built fully up to specifications, gives most excellent results, far exceeding in its low limit of weight per horse-power any other motor, either American or foreign, it has been difficult to secure that uniformity of high-grade workmanship which is absolutely necessary, if the motor is to be submitted to the terrific test of ordeal by battle.

Now this does not mean that quantity-production is a failure. It is far from that. Indeed, there is reason to believe that, when the American mechanic has been trained to work to the extreme nicety required, we shall be able to produce quantity-production motors that will be up to standard. This, however, will take time, and the battlefields of France cannot wait upon the perfection of shop methods and the training of shop forces.

We understand that the Aircraft Production Board realizes that, if America is going to fulfill its promise to Europe of a great fleet of airplanes to be delivered at an early date, it will have to modify its original plans and not confine itself to the construction of one particular motor. It is evident that there has been some such change of policy to a limited degree; but we believe the change should be made more sweeping.

There are several high-class motors of foreign make which, although they may not be so light or so powerful as the Liberty motor, are proving to be thoroughly satisfactory in actual war service. To mention one for example, there is the Hispano-Suiza motor, which is used in the famous French Spad machine, in which the great Guynemer made his reputation. The Hispano-Suiza is being built in this country, and we understand that a single firm is turning these out at the rate of a dozen per day, and that the output is of the very highest grade and is successfully passing all tests.

Therefore, in view of the urgent demand, the Government should at once place large orders for the Hispano-Suiza, the Rolls-Royce and other first-class makes; and it should encourage such shops as are qualified to undertake their construction, by giving them all the financial assistance necessary. Particularly should those shops which are already at work on foreign motors be enlarged, so that their output may be doubled or tripled according to the possibilities of extension. This can be done while quantity-production of the Liberty motor is being brought up to the high level of quality and output which is necessary.

It would have been very satisfactory, of course, if we could have committed ourselves exclusively to the construction of an American-designed motor; but we are not in this war to flatter our national vanity; we are out to win and to win at the earliest possible moment. The Liberty motor will be built in increasing numbers and if it fulfills its great promise, it may ultimately become the standard drive for our American air service; but meanwhile, we should build every kind of motor that has proved itself in the war, and enlist for the construction of these motors every engineering firm that can profitably be utilized for this work.

Reforms in Time-Keeping

WE are living in an age of revolutions; the strongholds of conservatism have been broken down, and in all spheres of human activity novelties are the order of the day. In the matter of time-keeping several interesting innovations are now either on trial or under consideration.

1. The so-called daylight-saving plan, which was an object of ridicule a few years ago, is now in operation over the greater part of the civilized world.

2. The standard time zones of the United States have at last, by the terms of the daylight-saving law, been given federal recognition, and the Interstate Commerce Commission has been instructed to delimit them. These zones were originally adopted by the railways, and have been legalized by some of the state legislatures, but not previously by the Federal Government.

3. A movement on foot in New Zealand to bring the standard time of that colony into conformity with the system founded on the meridian of Greenwich will probably be taken up in the other colonies and countries where, as in New Zealand, standard time now differs by half-hours from the regular hour zones. New Zealand time is now 11½ hours faster than Greenwich time, and the proposal is to make it 12 hours faster. Similar reforms are needed in India, Burma, South Australia, Nigeria, British East Africa, Venezuela, Hawaii, Samoa and Guam.

4. The use of standard time at sea is on the point of supplanting the present heterogeneous system of ship-board time. This reform has already been put in operation in the French and Italian Navies.

5. A proposal to change the beginning of the astronomical day from noon to midnight, in order to conform to the civil day, is being discussed by the astronomical societies and authorities of Great Britain and America.

6. A similar change in the nautical day was recommended by the British conferees above mentioned.

7. The plan of numbering the hours of the civil day from 0 to 23, thus abolishing A. M. and P. M., continues to make progress. The latest country to adhere to this plan for official purposes is Greece, while a strong movement in favor of it is reported from Switzerland.

All of these reforms except the first are steps in the direction of consistency and uniformity, and are logical results of improved methods of communication between and within nations. Parochial systems of time-keeping no longer serve the needs of humanity. Even the mariner in midocean no longer has any excuse for keeping time by the sun, now that wireless has brought him into constant connection with *terra firma*.

The future may witness even more sweeping reforms. For many practical purposes it would be an advantage to use the mean solar time of Greenwich throughout the world. At present, when we read in the newspapers that some distant event has occurred or will occur at a certain time, we must perform a mental calculation to determine the hour and often also the date of its occurrence according to our own clocks and calendars—truly a paradoxical situation in an age when the telegraph is supposed to have annihilated space.

Electricity

Electricity on the Farm.—It is apparent from the fact that 200,000 horse-power in electric motors is now actually being used on the farm that the phrase "Electricity on the Farm" does not constitute an idle dream any longer, remarks the *General Electric Review*. Although 160,000 horse-power of this is used for irrigation and reclamation purposes (a peculiarity to semi-arid sections), the remainder, or 40,000 horse-power, is actually being used for miscellaneous farm purposes, such as driving the cream separator, butter churn, and so on. The only thing that we are not doing with electricity on any scale is plowing and cultivating, and this now bids fair to be a commercial reality in the very near future.

A New Use for X-Rays.—From the spectra obtained by exposing crystals of two different substances to X-rays of the same wave-length, according to C. W. Kanolt writing recently in *Science*, the ratio of the distances between adjacent layers of atoms in the two substances can be easily determined, as is well known. If the relative distances are determined in the direction of each crystal axes, these results, together with the inclination of the axes to each other in each crystal, enable one to calculate the ratio of the volumes of the elementary parallelopipeds of each crystal. From this ratio and the ratio of the densities the ratio of the molecular weights can be easily calculated. From the ratios of molecular weights atomic weights can be calculated in the usual manner. After suitable apparatus has once been set up this method should permit the determination of the atomic weights of a considerable number of elements with less consumption of time and in most cases with greater accuracy than the chemical methods that have been used hitherto.

Maintaining Trolley-Car Lighting Voltage.—The range of illumination on interurban trolley cars is pretty generally known, for the lights often surge from the poorest kind of light to a blinding brilliancy, due to changes in trolley-line voltage. Not only is this condition most objectional to the passengers, but in cases where headlights are depended on and where they are operated directly off the trolley-line current supply, there is constant danger owing to the motorman being unable to see a sufficient distance ahead of him, and to the absence of a warning beam of light to automobile drivers and pedestrians at road crossings. Recently a leading electrical manufacturer has introduced a motor-generator set intended for use on trolley cars for the purpose of maintaining a steady voltage supply for the lights. No matter what may be the range of speed of the motor-generator set due to fluctuations in the current supply, it is claimed that it will maintain satisfactory illumination over a voltage range of 600 to 200 volts on a 600-volt trolley-line supply.

Edge Effect in Copper Bars.—The results of experiments made to determine the extra resistance due to non-uniform current density in large copper bars carrying alternating currents at 60 and also at 25 cycles per second, have proved interesting. Under the conditions which existed in the test, the ratio of the alternating-current resistance to the direct-current resistance is 1.1 to 1.3 at 25 and 60 cycles respectively. These results indicate that the edge effect in large copper bars is of considerable practical importance at ordinary lighting and power frequencies. The ratio of the alternating current resistance to the direct current resistance in circular copper bars having the same cross section as the rectangular bars investigated was less than half that found in the latter. The largest resistance ratio found was 2.2 at 61 cycles in the case of a loop 4.9 meters long with sides 5.1 centimeters apart. Each side of this loop, continues the *Journal* of the Franklin Institute, was composed of three copper bars in parallel, clamped in such a way that the individual bars were 6.35 meters apart.

How Our Army Will Do Away with the Cables.—The Navy Department is erecting a high-power radio station in France at a cost of $2,250,000, which will be ready for operation in August next. The French government will take it out of our hands after the war is over. It will be used in connection with the great station fast nearing completion at Annapolis, which will be greater than the one at Arlington, Va. The present French stations are not powerful enough for communication across the Atlantic Ocean, being of about the same power as the station at Arlington. All of the equipment and structural parts, continues *Wireless Age*, are being made in this country for the foreign station. A station is also being built in Porto Rico. The British are establishing a high-powered station in the Azores, which will be valuable as a relay station. At present about 30,000 words a day are possible by wireless, and the new station at Annapolis will add 50,000 words per day. The greater part of the communication at the present time is by cable. If the cables are cut, it is estimated that the Annapolis station and Sayville and Tuckerton would probably be able to take care of all absolutely necessary military business. There is but little necessity for the use of the Pacific coast stations at this time as practically all of the naval operations are on the Atlantic coast.

Astronomy

Dr. Otto Klotz, the well-known geophysicist, has been appointed chief astronomer of Canada and director of the Dominion Observatory, in succession to the late W. F. King.

Another Nova in the Andromeda Nebula.—Photographs of the Great Nebula in Andromeda made with the 60-inch reflector of the Mt. Wilson observatory, October 13th and 16th, 1917, show another faint nova; magnitude about 18. It is invisible on plates made in September and earlier. This is the fifth nova that has been recorded in the Andromeda nebula, including the well-known one of August, 1885.

Jupiter in 1916.—According to a report by the Swiss astronomer F. Le Coultre on his observations of Jupiter during the opposition of 1916, the atmosphere of the planet exhibited remarkable perturbations. The northern hemisphere was the more disturbed, with evidences of most violent activity in the equatorial and tropical regions. A new red spot appeared in this hemisphere in the dark region between the equatorial and tropical belts.

An Interesting Stellar Spectrum.—Mr. C. C. Kiess reports that from a series of 67 spectrograms of Alpha Canum Venaticorum made at the Detroit Observatory, Ann Arbor, two groups of variable lines previously reported by Bélopolsky have been verified and identified as lines of europium and terbium, respectively. Many other faint lines, not known to be variable, have been identified with the stronger lines of yttrium, lanthanum, gadolinum and dysprosium.

Two Rapidly Variable Nebulæ.—Series of photographs made at the Lowell Observatory show striking changes in the variable nebulæ N. G. C. 2261 and N. G. C. 6729. The former changed markedly in form between March 1916, and January, 1917, and small changes in detail are perceptible for intervals of a few days. The latter, in Corona Australis, appears to be considerably more active than N. G. C. 2261; in some instances there are evidences of change in detail in negatives taken one or two nights apart. Both nebulæ have irregularly variable stars as nuclei.

Statistics of the Pleiades.—There has been much uncertainty as to the angular dimensions of the Pleiades and the number of stars belonging to this cluster, as distinguished from "background stars," not physically connected with it. By two independent methods—star counts and a study of proper motions and spectra—R. Trümpler is led to consider the Pleiades a cluster containing from 80 to 90 stars brighter than magnitude nine, and he finds the apparent diameter of the group to be six degrees. There is a central condensation nearly two degrees in diameter.

Haze Effect in Measurements of Solar Radiation.—Much attention was attracted a couple of years ago to the suggestion of Mr. R. E. De Lury that certain variations of results in spectroscopic measurements of solar radiation are due to the superposition, on the spectrum of a definite point of the sun's image, of scattered light from the sun as a whole, the chief cause of the scattered light being atmospheric haze. According to Mr. C. G. Abbot, the measurements of sky radiation in the vicinity of the sun made by the Smithsonian Astrophysical Observatory at Washington and Mt. Wilson indicate that on good observing days and with long-focus telescopes the suggested haze effect is far smaller than De Lury believes. Mr. H. H. Plaskett, of the Dominion Observatory, whose spectroscopic measurements were discussed by De Lury, also dissents from the latter's hypothesis.

Use of Dicyanin in Astronomical Spectroscopy.—During the past year the use of photographic plates stained with dicyanin has enabled the Bureau of Standards to extend the spectra of 32 chemical elements to wave lengths in many cases longer than 9,000 Angströms. This device is now being applied by astronomers to solar and stellar spectra; the red and infra-red regions of which have not heretofore been photographed with results comparable to those obtained in the remainder of the visible and the ultra-violet regions. Photographs of the solar spectrum with dicyanin-stained plates were recently made at Johns Hopkins, using a large plane-grating spectrograph, giving a linear dispersion of 2 A. per millimeter. Vibrations caused by heavy street traffic made exposures longer than twenty minutes impracticable, but good photographs of the spectrum were secured out to 9,600 A. Between 6,800 A. and 9,600 A. more than 1,700 Fraunhofer lines are shown, and 364 of these have been identified with emission lines in the spectra of 18 chemical elements. According to Mr. W. F. Meggers, who reports these results, it would be possible under favorable conditions to extend the record on the solar spectrum by this method out to 10,000 A. The sensitiveness of the plates to long waves suggests their use for the extension of chromospheric and sunspot spectra. Plates of the same kind have been used at Harvard College Observatory in photographing the spectra of stars, with interesting results, but the work is still in the experimental stage.

Automobile

The Brake Problem.—With the ever increasing weights of cars the braking problem becomes constantly more pressing. Many people think the prevention of skidding is a matter for which the tire manufacturers are responsible, but they certainly have done their part; and when this trouble is followed back to its source it is clearly evident that primarily it is a question of brakes, and not of tires at all. To provide a sufficiently powerful brake, and one that is at the same time convenient to operate is by no means an easy task, especially if pedal operated. If the pedal lever is short, to give a short movement of the foot, the leverage is not sufficient to give enough power without great muscular effort; and on the other hand, with a short foot movement it is practically impossible to properly graduate the pressure.

Juggernaut Cars.—The bicycle weighs about one-fifth of a pound for each pound of load, while the modern automobile will average three pounds per pound of passenger weight, or over. Big cars are supposed to be impressive, and impressions are much sought for by many people; and as the public also demands a big engine the manufacturers apparently think they might as well build a body that will give the engine something to do. Considered without prejudice, and disregarding "fashion," many of the monster enclosed cars seen today are certainly somber and mournful structures, and nearly akin to a moving van. Abroad the question of reducing weight is being seriously considered, and it is believed that something much lighter and at the same time more elegant than the present models can be devised, and after the war it is likely that there will be a decided change in fashions which will extend to this country as well.

Wasting Gasoline.—An immense amount of gasoline is wasted daily as a result of the excessively and unnecessarily large engines the public insists on having. There are thousands of 60 and 90 horse-power cars in use where 30 to 40 would be amply sufficient. Not only do these big engines require a very large quantity of gasoline, but, at the speeds they run 90 per cent of the time, these engines are operating very inefficiently, which means additional waste. The theory that a "reserve power" is a desirable quality in a car might have had some basis in by-gone days, before motors were as efficient and reliable as they are now, but that pretext no longer exists; still men like to boast of the power of their car, even if they never open the throttle—at least they don't do it the second time. Possibly the coming high cost of gasoline will bring a realization of the uselessness of excessively large engines, but that time will be too late to help out war necessities.

New Fuels.—The number of motor vehicles is increasing so much faster than the supplies of gasoline that the fuel problem is rapidly getting more serious. Alcohol has often been suggested, but it is not altogehter satisfactory, and the supply is not great enough to enable it to take the place of gasoline. Benzole has also been tried and while satisfactory, it too is not produced in sufficient quantities to become the universal fuel, and it would not be desirable to build several different kinds of motors to use the different fuels. A mixture of the available fuels naturally suggests itself, and experiments that have been made show that alcohol does not mix properly with gasoline, but benzole dissolves both alcohol and gasoline. It has been found that a mixture of 25 per cent each of gasoline, and benzole with 50 per cent of alcohol works very satisfactorily in our present vehicle motors, and as these proportions correspond fairly well with the output of the various ingredients that may be anticipated, this may prove to be the solution of the fuel problem—unless advances are made in the design of crude oil motors.

Misconception of the Good Roads Problem.—The occurrences of the past winter have developed a serious lapse in our good roads ideas that apparently had been generally overlooked. As long as the roads were in good condition for eight months of the year, or during the season when the joy rider delights to flit from place to place over the face of the country, everything was considered to be satisfactory, and if no roads existed for the four winter months, when no one is inclined to make tours, no objection was raised. The failure of the railroads last winter to meet the demands for transportation service, and the consequent necessity for using motor trucks between the great manufacturing centers of the middle west developed the absolute inefficiency of our roads. An automobile that could be operated only in good weather would not be tolerated, and our roads should be judged by the same standards. Much of our good roads legislation is a noxious mixture of State, County and Town politics, and the work is unsystematic, frequently superficial and too often not honestly done. The natural suggestion is to put it entirely in the hands of the National Government; but here again, Congress regards all such expenditures as "Pork," to be distributed as widely as possible, and with a view to political and not practical results, as is demonstrated every year in the Rivers and Harbors appropriations. The outlook for the honest, systematic development of our country is rather discouraging, but the people are themselves responsible for the kind of officials they elect to conduct their business.

How Wireless Helps the Mariner

Keeping Navigation Posted by Means of the Radiometer and the Radiophore

By Lieut. Robert A. Lavender, U. S. N.

THE development of radio, since its first practicable appearance, has been so rapid and its use in the transmission of messages has become so common, that it is not surprising that many new uses are continually being made of radio apparatus in general. As an aid to navigation the use of radio has previously been held with great suspicion; but within the last few years, more confidence has been placed in it.

Many methods have been proposed for estimating distances by timing the interval between the reception of simultaneously created disturbances projected through different media or of different distrubances through the same medium. The difference between velocity of light and sound through air was the first principle to be used and is now extensively used on the battle fields in Europe to determine the location of batteries. By the use of microphones and high speed chronographs or cinematographs, the location can be determined within 50 yards. This system is of value in clear weather, but is entirely useless during fog, rain or snow.

A system to determine distances by means of radio and submarine signals has been perfected and installed in the Fire Island Lightship. It is practically self-recording in that it eliminates the necessity of making any measurement aboard the receiving ship, such as using chronographs, stop watches or the use of tables or curves. All that is required is a radio receiver with a head telephone set to receive the submarine signals and the radio signals at the same time.

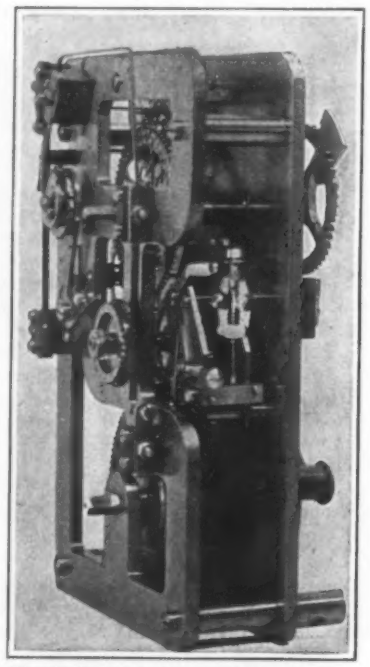

Fig. 3—Special chronometer with separate movements for wireless and sound signals

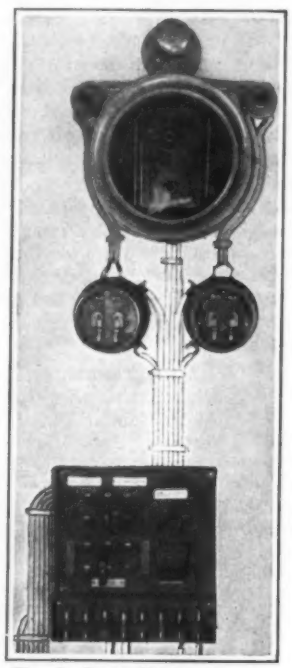

Fig. 4—Controlling apparatus for synchronizing wireless and sound signals

The system is based on the difference in velocities of propogation of sound waves through water and radio waves through ether. The velocity of sound waves through water for ordinary temperatures is 4,800 feet per second or one-half mile in .625 seconds. A variation of about four per cent may be expected for a 25 per cent change in temperature. The velocity of radio waves for ranges of the apparatus is considered instantaneous.

The submarine signal apparatus is the standard equipment of the Fire Island Lightship and in order that the distance-determining gear may not interfere with the operation of the submarine signals, the prescribed submarine signals are sent as usual and the first signal of the series is used as the submarine reference signal. The submarine signal consists of six impulses with a spacing of two seconds, then a silent interval of four seconds followed by eight impulses with a spacing of two seconds, then a silent interval of 12 seconds. This cycle is shown graphically in Fig. 1. By the inspection of Fig. 1 it is seen that the complete cycle forms the number of the light vessel (68), and is repeated every 40 seconds.

The radio apparatus is the standard quenched gap transmitter operated by storage battery. The size of the antenna is designed so that the signals will not be heard much beyond the range of the submarine signals, in order that unnecessary interference with near-by radio stations may be avoided. The general wiring diagram is shown in Fig. 2.

The contact for the radio set and for the submarine signals are controlled by a special chronometer which closes the contact for the radio transmitter every .625 second. A series of 15 radio signals are sent out which covers the interval of 8.75 seconds, the first radio signal being sent out .625 seconds after the first impulse of the submarine signal cycle. This is shown graphically by the arrows in Fig. 1. The chronometers for the radio signals and for the submarine signals are contained in the same unit as shown in Fig. 3, but are run by two different movements. As it is difficult to synchronize by timing adjustment the two movements for any great length of time, they are synchronized mechanically by a special cam at the beginning of each submarine signal cycle. The controls as installed in the ship are shown in Fig. 4.

The receiving system may be explained as follows:

If a submarine signal-transmitting apparatus and radio transmitting set be installed at a certain point, and submarine signal receiving and radio receiving stations be located at intervals of one-half mile from the transmitting stations and signals sent out as shown graphically in Fig. 1, the position of the two series of waves, at the various time intervals would be:

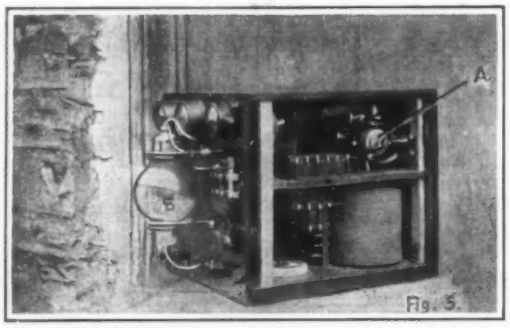

Fig. 5—Radio telephone set of the radiophore, with the phonograph mechanism shown at "A"

At 0.000 seconds first submarine signal is sent out.

At 0.625 seconds first radio signal is sent out and is heard simultaneously at all stations; the first submarine signal has reached the one-half mile station and is received simultaneously with the radio signal.

At 1.250 seconds the second radio signal is sent out: the first submarine signal has reached the one-mile station and is received simultaneously with the second radio signal.

At 1.875 seconds the third radio signal is sent: the first submarine signal has reached the 1½ mile station and is received simultaneously with the third radio signal. By counting, then, the number of radio signals received before the first submarine signal is received, the distance, in one-half miles from the sending station is at once known. With a little practice the operator can judge the fraction of the interval between radio signals that the submarine signal arrives and thus determine the distance accurate to a one-fourth of a mile. There are no tables or calculations necessary. It is only necessary to count the signals and fractions received and that is the number of one-half miles the receiving is from the sending station.

Several acceptance tests were conducted to determine the accuracy of this instrument by anchoring a ship at a known distance from the Fire Island Lightship and noting data taken by four different observers. A second series of tests was made with a ship anchored in a position unknown to the observers. Examples of reading were as follows:

Observer	Distance observed
1	4
2	4+
3	4¼
4	4

Actual distance 8,000 yards

Observer	Distance observed
1	6½
2	6
3	6½
4	6½

Actual distance 6+.

Observer	Distance observed
1	2½
2	2½
3	2¼
4	2½

Actual distance 2.38.

During thick weather when a navigation light is most necessary, it is invisible and useless and as a result many ships are lost. Sound fog signals at their best are very unreliable as banks of fog make excellent sound reflectors. The wind has a deadening effect and may make the signals seem to come from another direction. As the observers of fog signals must be out in the open to listen to the signals, they may be drowned out all together by the noise of the wind or rain. Snow has a deadening effect and greatly limits the range of any sound signal. By the substitution of a suitable radiophone device for fog signals, all the variable elements of the sound fog signals disappear, for the propagation of radio waves is not affected by fog, rain or snow.

The radiophore (radio lighthouse), has been developed to send out radiophone warning signals automatically and is shown in Fig. 5. The sound for the radiophone is produced by an Edison phonograph (see *A*), of the automatic repeating type using Ambrol records. The name of the light is repeated every five seconds, the intensity of the sound and the radiation of the transmitter being so designed that ships equipped with an ordinary antenna will hear the signal the same approximate distance that the light could be seen in clear weather. In order to warn the listening ship of its near approach to the light, the phonograph, after every third repetition of the name of the light, sends out in a much weaker voice the warning "You are getting closer; keep off." The intensity of the sound of these signals is so designed that the ship will hear it only when close in to the light.

The radio transmitting apparatus is a small radiophone set of the De Forest design, using storage battery and

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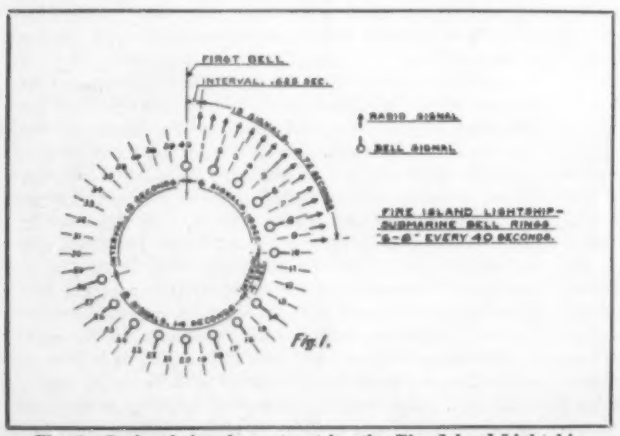


Fig. 1—Cycle of signals sent out by the Fire Island Lightship every 40 seconds

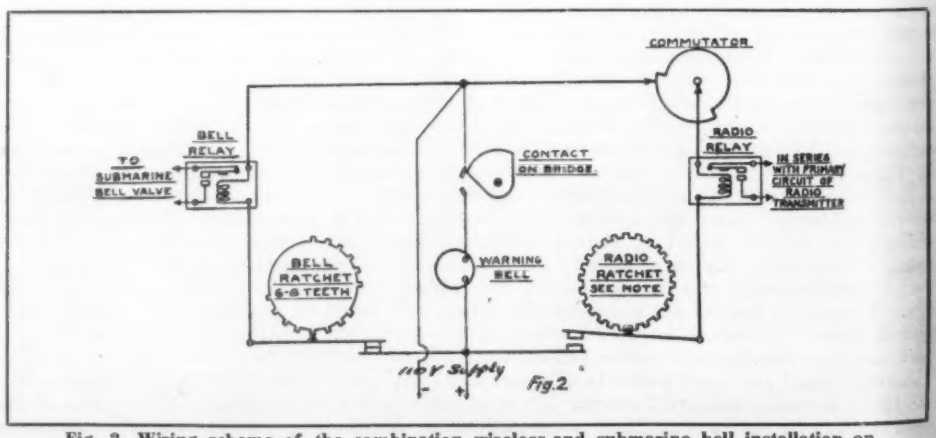
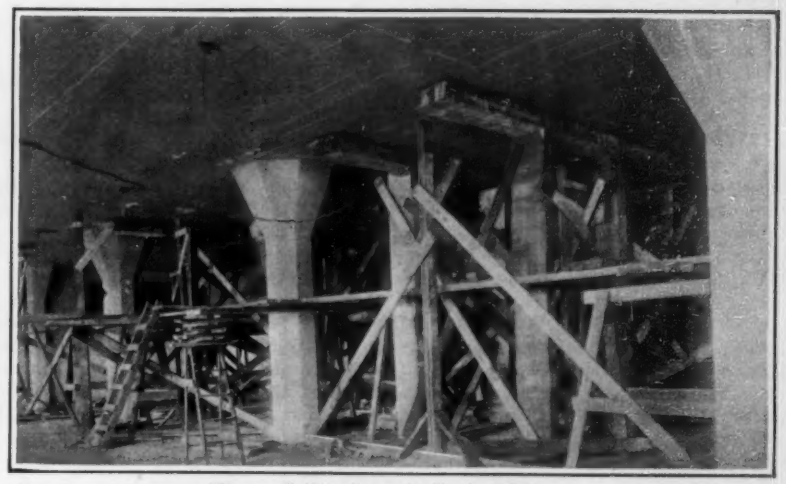


Fig. 2—Wiring scheme of the combination wireless and submarine bell installation on Fire Island Lightship

The full load of pig iron—910 pounds per square foot



The scaffolding beneath the test floor

Vivisection of a Condemned Building

SUBJECTING the floor of a modern structure of concrete with steel reinforcement to the weight of a million and a quarter pounds of pig iron in order to determine what scientists call the "point of destruction" was the remarkable test recently carried on in Chicago by Prof. A. N. Talbot of the University of Illinois. According to Prof. Talbot, this is the first instance on record where such a test has been made on a building which had not been especially constructed for a test and which had been in service for a number of years.

The opportunity to make the test came about as the result of the wrecking of a large number of buildings to make way for Chicago's new Union Station. Among these buildings was a reinforced concrete structure erected in 1909, designed to carry heavy printing machinery, and after eight years of use still in perfect condition. Pebble aggregate was used in the concrete and its quality, from inspection of sample pieces broken from the floor before the test, seemed excellent, a fact which was later borne out by the stresses it withstood under the test load.

The sixth floor of the building, which was the one chosen for the test, was a four-way flat slab construction designed for 250 pounds live load. The test load was applied in increments of approximately 200 pounds per square foot, until a weight of 910 pounds per square foot had been reached, the time between the first and last loads covering a period of twelve days.

Gage lines on steel and on concrete and deflection points to the number of 200 were arranged. The gage lines were selected with a view of getting information on the strains in the steel and concrete at critical places and to learn the action of the flat slab under heavy load. After each increment of pig iron had been put in place measurements were made on the gage lines, and other measurements were taken each day.

It had been expected that the reinforcement was mild steel, but bars taken from the floor in different parts of the building gave a yield of 65,000 pounds per square inch and an ultimate strength in the neighborhood of 100,000 pounds, indicating high carbon steel. Judging from its performance, much of the concrete had, during the eight

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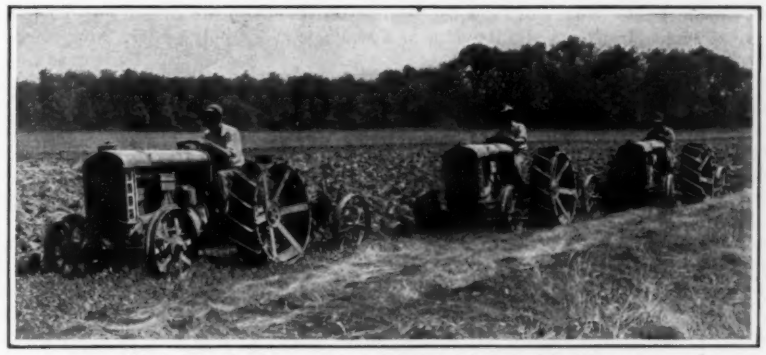
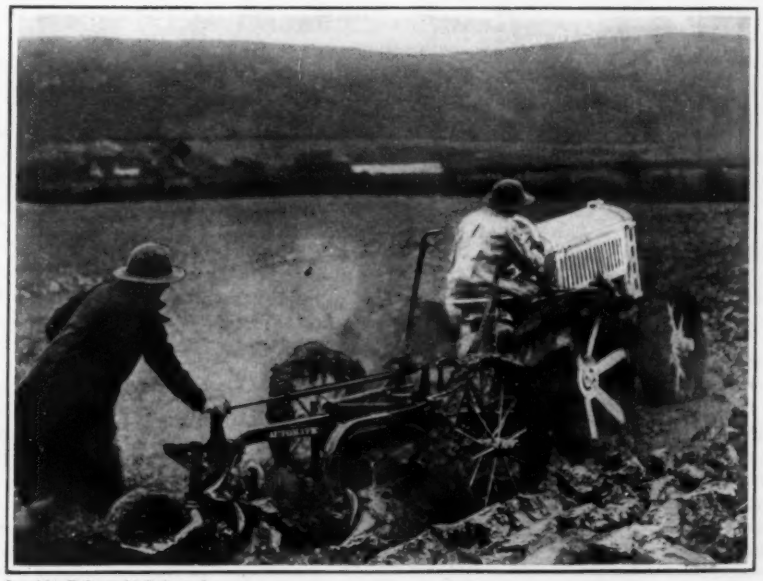


Wholesale plowing under governmental control in England



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A novice making her first field run with a tractor

Night Farming by Women in England

COINCIDENT with Government control of food distribution in Great Britain, there has been inaugurated an ever increasing measure of Government control of food production. It will be realized that this is a vital necessity; even in this country, where the drain upon the industries has not been nearly so severe nor so prolonged, we are beginning to feel the pinch for certain classes of workers. Certainly the only way in which food production in England can be saved from total confusion is by the keenest sort of central administration.

So Great Britain has organized a plowing army. Tractors and drivers have been mobilized for the most intensive sort of a drive against the vacant land of the United Kingdom. The machines themselves are in most cases Government property, a large part of them being of a well known small American make, secured for this work by special arrangements with the manufacturers. They are sent in groups of any necessary number to a given district, and are used on a schedule of 24 hours per day, in three shifts, until all the big plowing of the district is done. This, of course, means night plowing by artificial light, as shown on our cover; but here for once time is of more value than light.

Some men are employed, but the majority of the drivers and mechanics are women. A thousand drivers alone have had to be recruited recently. Complete arrangements are in effect for instruction and gradual breaking in at the actual field work—arrangements in which the agricultural colleges are a factor of importance.

A special effort is being made to qualify women for positions as farm bailiffs, or superintendents, as we would have it on this side of the water. That this work is popular is evidenced by the fact that at one institution there were 300 applicants for 15 scholarships which had been offered. Several farms that had been badly run were turned over to woman bailiffs with woman workers exclusively, and they have made a big success of the venture.

A woman superintendent of a British farm

Tractor-driver oiling her machine

Strategic Moves of the War, April 3d, 1918

By Our Military Expert

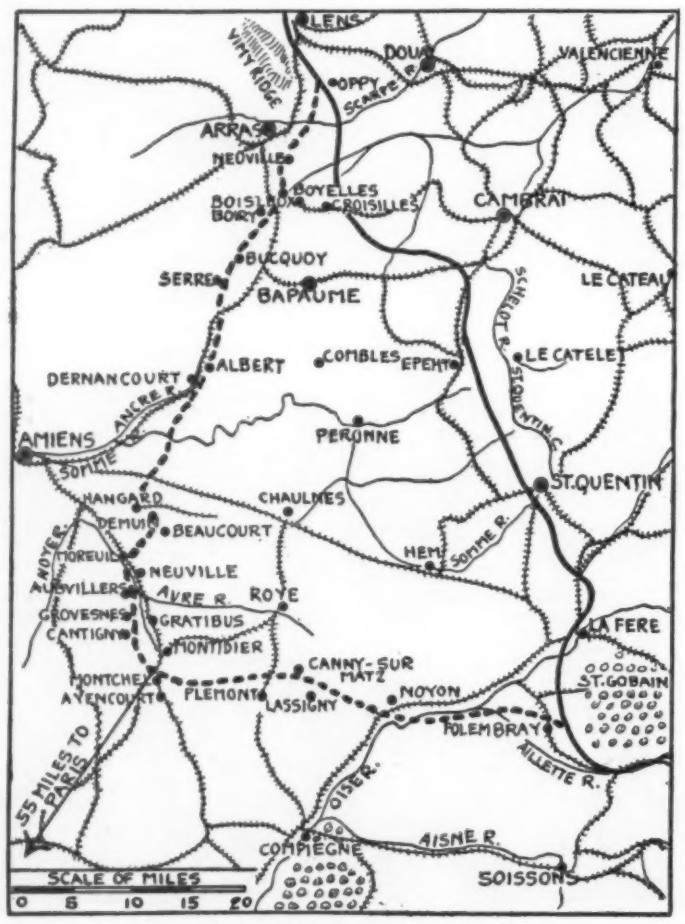
THE world has witnessed in the past two weeks the greatest struggle of armed forces that has ever occurred since history began its record. There is no doubt we are at "the decisive moment of the war" as the Kaiser has so vehemently proclaimed, though the decision may ultimately not be exactly as he wishes it. When the British and French troops were forced to retreat from Belgium in 1914 in the face of overwhelming numbers, Germany felt sure that not only were the Allies defeated but that their morale was utterly broken. For a time the armies were even out of touch with one another and utter rout seemed inevitable. But the results of the battle of the Marne and the vigorous pursuit of the retreating Germans to the Aisne revealed a mental and moral as well as a physical strength in the Allied armies that, at the time, amazed the world. Today and for days the Allied lines have been under pressure and have been bent back over a front of more than fifty miles; but they are very far from having been broken. The French, although desperately beset on the southern end of the line, have not only held their own but have been able to take over a part of the British lines. The British troops have delivered a gigantic battle against overwhelming odds and have made numerous counter attacks that have checked a threatening advance against various strategic points of their own exposed sectors.

At the present writing the first phase of the German offensive appears to have ended and a summary of what has occurred and of what has been gained by them and lost by the Allies will not be out of place. It can be noted here that while gain of territory has shown on the maps, this has by no means been the prime object of the great German offensive. That object has been the destruction of the Allied armies—the only means by which any successful conclusion of the present conditions can be reached so that peace terms can be enforced. And that destruction is no nearer today than in even more critical periods of this great war; the stubborn resistance of the British in their retreat and the elan of the French on the southern end bode ill for any termination that will be to German advantage. The ultimate effect has been the continuance of the touch between the British and French armies and the holding of an unbroken front that has so far prevented the threatened breaking through of the lines. The defensive strength of the lines and the success in holding them intact will depend entirely on the well known resistance already offered by the British and French, aided by the American and Portuguese contingents.

The losses of the enemy up to the present have been enormous—greatly in excess of those of the Entente Allies—and must be counted in the weakening of the fighting forces despite the enormous number of reserves already thrown in. So far it is computed that 90 divisions or one-half of all their fighting strength on the western front have been put into the battle lines and it is believed a safe assumption that the losses in the desperate assaults made have been from thirty to fifty per cent of all engaged. The effects of such enormous losses will be shown when the great allied reserves come into action—counter attacks that may begin at any moment. These effects will also be an important consideration in their bearing on the whole war, because the desperate stakes for which the Kaiser has been playing may be lost; and the German people will no doubt then demand the penalty. The German attacks have been pressed with a view to an early decision and with no account whatever taken as to loss of lives. This battle appears to be the last desperate throw of the dice; if it does not go well, there will undoubtedly be internal disruption of some sort.

The front selected by the Germans for the attack extended from near Arras on the north to include the salient at Cambrai and ran then through St. Quentin to La Fère on the Oise. The heights and forest of St. Gobain protected their left flank in any forward movement. This front of attack exceeded in length any selected by either side during the present war and extended over a distance of approximately fifty-five miles. By using such a length of front, any point of weakness could be determined much more easily than if a shorter distance had been selected. The ground along this particular section was also in a much more favorable condition than that further north, the elevation permitting drainage at this season, thus leaving the country relatively dry. In addition, as this part of the front was almost wholly occupied by the British troops, it was intended that they should bear the brunt of the attacks. It was apparently believed by the Germans that, as the British army was largely an improvised one and hardened only to trench warfare, it would fall an easy prey when forced to a defensive in the open. The results, so far, of such calculations must be a dreadful blow to German hopes; for no troops apparently ever fought better in the open and on the defensive than has been the case with the English armies in the present crisis.

The strategic consideration leading up to the attacks in the present advance seem to have also received from the Germans most thorough study before the fighting began. By striking in the southern part of the line toward St. Quentin and LaFère, it was hoped that the junction of the British and French armies could be broken, thus causing confusion and lack of coöperation between them. Such a break would also threaten Paris which was only 70 miles away from the nearest point of the German lines. By breaking through in the Cambrai region, the English communications with the Channel ports could be cut and the supply lines would be so congested that confusion would result. This would be especially the case if Amiens could be reached since the roads from that city to the Channel ports are the main arteries of communications with England. A glance at the map will show the relation of Amiens to the British front and also its value as a strategic and supply center.



The Battle Line in Picardy, April 3d, 1918

The German attack was begun early Thursday morning March 21st by a terrific bombardment preceding a furious assault upon the salient in front of Cambrai both from the east and the north. It is calculated that, in their first drive, the Germans used about six hundred thousand men with an available reserve of four hundred and fifty thousand. With such a preponderance of strength and of guns upon a limited front, the British were actually overrun by sheer weight of numbers and were forced to fall back. They lost a number of guns; but, before doing so, the guns gave a good account of themselves against the dense masses of the enemy. It is said that in the preliminary assaults the Germans had more than a division to each mile of front; no assaults were ever before delivered with such masses of men or with such high proportions of losses.

The capture of the Cambrai salient from the English opened up the way for the development of the attacks along the entire front selected, especially for the main attack that took place further south at the junction of the French and English lines. Here too the Allied front gave way before the first rush of overwhelming masses though the lines were never broken. They only bent under the strain, the French continuing to hold south of the Oise River.

The main British defensive positions above St. Quentin and around Holnon wood were pierced and their troops driven back so that the northern part of the line swung to the rear, hinged upon a point at the ruined village of Roeux just in front of Arras. Here a tremendous thrust was delivered against the north end of the line by a most determined attack of the Germans with a force of seven or eight divisions, about ninety thousand men. As all this ground was commanded by the British positions on Vimy Ridge and by the heights of Notre Dame de Lorette further north and west, the attack was a complete failure with enormous losses to the assailants. The struggle along the entire front has kept up for days; finding that north of the Somme River nothing could be gained, the Germans have directed all their efforts to an extension between the Somme and the Oise in the direction of Amiens. But, as the country behind them is both battle scarred and a sea of mud, it has been impossible to bring up heavy guns; until that is done, little progress can be made in that section. The French, who had taken over the British lines to and beyond Montdidier, came to a halt behind the west bank of the river Avre, a small tributary of the Somme at Amiens, and they have also held to and south of the Oise, joining their original line near the Aillette River at Aniz-le-Château.

There can now be no doubt that the salient, as held by the Germans, is one of great danger to them if the Allies can bring up reserve armies. Should the French be able to make a successful attack on the southern leg of their line from a point on the Oise to and beyond Montdidier, the success of such a movement would spell disaster for the Germans in their present salient position. And, this danger grows as they deepen their salient—a danger that must be apparent to them unless they are fully prepared to meet the shock. There is a limit beyond which they cannot go and that is established by the difficulties of bringing up supplies, ammunition, and guns through the relatively narrow opening of a salient. Then too, as the salient is extended, the greater will be the length of front over which such a flank attack as that outlined can be made.

At the present time the Germans are about six miles from the main line of railroad from Amiens to Paris and further north they are only 12 miles from Amiens. Both the railroad and the city are being shelled; but, whether the Germans will dare go further forward and accept the risks remains to be seen. Chief interest is centering in the operations and developments in the region extending from the Oise below Noyon up to the road from Peronne to Amiens. The crucial struggles of the great battle now in progress and perhaps of the present war, may develop in this part of northern France.

Just now the Germans seem somewhat at sea as to the main direction of attack; at first it was on the wings at Croiselles and below St. Quentin to LaFère. It was then transferred to their right center at Bapaume and toward Albert; it has now concentrated on the left center in and around Montdidier. It is evident that unexpected resistance has been encountered at these various centers; the changes in the direction of the main attacks certainly show neither confidence in their own strength nor weakness in different parts of the Allied lines. The earnest coöperation of our relatively small force that was behind the lines and the appointment of the French General Foch as generalissimo of all the Allied armies have given renewed confidence to the hard pressed British, French, and Portuguese troops and have gone far to remove pessimistic views as to the ultimate results of the great battle. Certainly it would seem that the German advance has plainly reached its extreme western point. As long as they have failed to progress on the front from Montdidier to Noyon and in view of General Foch's assertion that he can guarantee the safety of Amiens, the first phase of the battle in Picardy may be regarded as drawing to a close.

In this connection, the movement in the direction of Amiens has in a way diverted attention from the true meaning of the failure of the Germans in their attack on Arras on March 28th, since the particular attack here was no less heavy than that toward Amiens. The German objective was not only to take Vimy Ridge but also to outflank it on the south and to break the British lines. But it happened that the British were more strongly concentrated there than they were between Cambrai and LaFère and for good reason; Arras is the northern pivot of a line of which Noyon is now the southern one; it was essential for the Allies to hold both because here

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Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

A Tractor Controversy

To the Editor of the SCIENTIFIC AMERICAN:

I read an article by Mr. Edward C. Crossman in your Twentieth Annual Motor Number of January 5th, and was particularly struck by the amount of misleading misinformation contained therein. I am inclined to believe that some interested and unscrupulous individual "put one over" on Mr. Crossman.

I am a planter in the rice belt of Louisiana, where there are probably as many tractors of all kinds used, as there are in any equal area in the United States. I have been in close touch with the development and evolution of the Tractor for the past six years, having purchased one of the first tractors used in this section, a four-cylinder machine. I have seen the "slow-speed" one- and two-cylinder tractors weighing approximately 1,000 pounds per draw-bar horse-power practically superseded in this territory by light weight, high speed machines weighing about 500 pounds per draw-bar horse-power, with practically none of the frame racking, fuel consuming, power absorbing vibration, which seems inseparable from the slow-speed one- and two-cylinder types.

This evolution to lighter, higher-speed motors has resulted in a marked saving in the fuel and repair expense of tractor operation; and it is undoubtedly a fact that an up-to-date, four-cylinder, vertical-motored tractor of 20 horse-power will pull its full rated load on plowed ground with about one-half the fuel per hour that is required by a 15 horse-power "slow-speed" one- or two-cylinder tractor, under similar conditions.

Mr. Crossman says "The successful tractor of 1917 seems to be standardized by the installation of a simple, sturdy, low-speed motor, not at all of the automobile type." The question naturally arises, where does he get this "low-speed-two-cylinder" stuff? Every maker of the caterpillar or apron type of tractors and all the principal makers of the wheel type tractors, has always used the four-cylinder automobile type motor in their machines and others are coming to the four-cylinder motor as fast as they consistently can.

A few years ago there were a great many one- and two-cylinder motors used in alleged automobiles (they certainly lacked a lot of being either automatic or mobile); but in this day of advanced ideas of motor construction, such a motor in an automobile would be a joke. Just so a similar motor would be a joke in a tractor after a very few more years of development along lines of efficiency and economy of fuel and repair expense.

It is an axiom that it requires power to move weight and it is also axiomatic that the amount of power required increases in about the same ratio as the footing over which it must be moved becomes more difficult. Therefore it should not take a very high order of intelligence to see that a slow-speed, two-cylinder tractor, weighing approximately 1,000 pounds per horse-power, will use a great deal more fuel to move itself and its load on soft ground that will a so-called high-speed four-cylinder tractor, weighing only about 500 pounds per horse-power.

Unnecessary weight and vibration have always been the great drawbacks in the development of the automobile and its big brother the field tractor; and no sane man will now dare to affirm that these can be eliminated in any other way than by the multiplication of cylinders. In this connection, let me call your attention to the new Liberty Motor, with its 12 cylinders, weighing only two pounds per horse-power, now being built by the Government for our flying machines, where the most exacting and gruelling service is demanded and where weight and vibration must of necessity be almost nil.

If it is an advantage to equip an automobile, which usually has a good, hard road to run on, with four, six, eight and twelve cylinder motors, how much more reason there is for equipping the field tractor, which has to pull its load over soft and yielding footing, with a motor which will give it the maximum of power with the minimum of weight and vibration, which means the minimum of fuel and upkeep expense.

In fairness to the makers of the bulk of the tractors sold in this country and justice to the people who may be led astray by such ill-considered articles as that of Mr. Crossman, which must have inadvertently slipped past your "censor," I ask that you please give this letter the same prominence.

H. L. CARY.

Jennings, La.

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Cary is an example of the type so often met by writers and editors—a person who reads into an article far more than the author put into it.

His remarks as to the tractor article offer a case in point. He inquires anxiously where I get "this low-speed, two-cylinder stuff." The query is, rather, where does Mr. Cary get it?

There was contained in the tractor article no advocacy of any type of tractor nor any type of motor, nor yet any prophecy as to the future. All that was said was that the tractor of 1917 seemed to be standardized by a sturdy, low-speed, two-cylinder motor. This has been expanded by the fervid imagination of the too-hasty Mr. Cary into an advocacy of this type, and a prophecy as to the future. All of which reminds us that before writing to contradict another, it is well first to read carefully.

Likewise as I was at the tractor demonstration in question and obtained the figures for western sales, and as Mr. Cary was not at this demonstration and confines his broad experience to the ownership of one machine, and a number of catalogs, possibly I was in better position to sum up what I found than is Mr. Cary.

Attempting to use the development of the airplane motor as an argument for the same type in the tractor, betrays a sad looseness of thought indeed. Where in the one case light weight and excess power are absolutely necessary, in the other case light weight is out of the question because traction itself depends to a great extent upon weight. Also power is not the sole consideration as it is in the plane, which is in effect merely an engine on wings. As Curtiss has said, give him an engine powerful enough and he'll fly on a card table.

Likewise the very lightness and high speed of the plane motor condemn it to a life so short that the tractor buyer using the same type of motor would "go broke" trying to keep the machine running. From 100 to 250 hours is the life of the plane motor of the finest type—the 250-hour figure being that of the finest and most costly motors.

Because of the peculiar gearing down of the tractor to gain power and even torque, the engine parallels the engine of the plane in that it works at nearly maximum speed all of the time, where the motor of the automobile rarely works at half of this.

Mr. Cary's remarks as to weight and horse-power—rather draw-bar pull—afford us a fair line on his knowledge of tractors and his justification for attempting to set the world at rights as to the tractor situation. I am not a planter, but I have had sufficient journalistic experience to investigate before writing. Likewise my observation of persons who claim to be expert by mere virtue of owning an example of the thing in which they claim to be expert does not bear out their claims as a rule. Most motor car owners and most users of firearms know very little of their pet cars or their pet guns, and the mechanics thereof—but nearly all of them think they do.

We are told about the evils of the slow-speed, two-cylinder tractor weighing 1,000 pounds per horse-power. We are also told that the correct proportion is about 500 pounds per horse-power. Having thus obtained the definite figures from the gentleman as to the correct proportion, we'll consider the type of wheeled tractor that has sold in greater numbers than any other made.

It weighs 5,000 pounds. The draw-bar pull of this machine is 12 horse-power. Wherefore the problem is 5,000 divided by 12, and the answer is 415 pounds per horse-power, in round numbers. Mr. Cary talks about 1,000 pounds per horse-power for such machines.

Wherefore, to copy the courteous expression of the gentleman: "In fairness to the makers of the bulk of the tractors sold in this country and justice to the people who may be led astray by such ill considered articles as that of Mr. Cary I ask that you please give this letter the same prominence."

Consider the misleading and erroneous statements of a person who alleges that low-speed, two-cylinder tractors must weigh 1,000 pounds per horse-power, when as a matter of fact the most popular make of this type weighs less than this by nearly 600 pounds, and weighs less than Mr. Cary's ideal figure, by 90 pounds. Taking for granted the fact that he is accurate, as becomes the self-appointed critic, at least as regards his favorite type of tractor, then it would appear that he is dragging around 85 to 90 pounds per horse-power, excess weight, because of using the very type of motor he advocates.

As pointed out, I acted as neither advocate nor prophet as to any type of motor, nor do I do so now. It is well to point out, however, what every well informed person knows, that the automobile and the tractor afford no parallel. The tractor cares nothing for the quick getaway and lack of noise of the multi-cylinder automobile. The tractor is a machine to haul plows and harrows and such things, to do it with economy and to stand up under abuse and hard work. The farm-hand running it is likely to be thoroughly skilled in the mechanics of the horse-drawn rake; but higher than this his training is likely not to extend.

Multi-cylinder machines multiply possible trouble and surely multiply expense when up-keep and repairs are considered. Likewise consider the gasoline mileage cars. Does any well-informed man state that multi- figures of four-cylinder, six-cylinder and twelve-cylinder plication of cylinders cuts down fuel consumption? Without doubt the multi-cylinder engine is a nicer and more efficient engine than the one with fewer cylinders, but the man buying the tractor has to consider the matter from a number of angles—the chief consideration being the simplicity and sturdiness and lack of parts to cause trouble, and the fewness of parts in which to hunt the inevitable trouble when it does occur. Can Bill Jones, the neighbor's boy with a smattering of motor-cycle mechanics, keep the sturdy and simple two-cylinder engine running more easily than he can one of say six cylinders? Common sense says that he can.

I believe that the tractor of the future will have four cylinders—when knowledge of gas-engine mechanics is more wide-spread, as it will be after the war, with the return of the tens of thousands of airplane crews. But I know what sold in 1917, and I do not believe there is any multi-cylinder tractor at present superior to the type that proved most popular in that year. And last but not least, I do not believe it is necessary to falsify figures to prove one's point—such as alleging the necessity for weight per horse-power when investigation proves the proportion alleged is just 50 per cent wrong.

Los Angeles, Cal. EDWARD C. CROSSMAN.

To the Editor of the SCIENTIFIC AMERICAN:

We want to thank you for calling our attention to the letter of Mr. Cary, of Louisiana. We think that this correspondent has not kept in touch with recent developments in the tractor line, or he would not have made the statements he has.

He talks about the two-cylinder tractors weighing approximately 1,000 pounds per horse-power draw-bar pull, which of course is perfectly absurd. One popular two-cylinder tractor with a draw-bar pull of 12 horse-power weighs about 5,000 pounds, which is far from being any such weight as Mr. Cary indicates. Any man who advocates a high-speed multiple-cylinder motor for a traction engine has had no experience upon which to base his judgment. As a matter of fact these high-speed motors do not stand up at all under heavy usage, as they rapidly shake themselves to pieces, while the multiplication of cylinders means a largely increased number of parts, and liability to trouble.

There is a wide difference between an airplane that must of necessity have large power with small weight and a traction engine that reqires a certain amount of weight in order to get traction. Mr. Crossman is quite right in his estimate that the fewer cylinders and the slower speed would be the proper engine for traction purposes in the future.

W. L. C. Co.

(Engine and Tractor Dealers.)

Farming Needs

To the Editor of the SCIENTIFIC AMERICAN:

Grain growers who are on hilly land need a light weight grain binder. The present binders are too heavy for any thing but level ground. It is a matter of light weight machines of high grade steel and not one of radical change of design. The cost of such a machine is of secondary importance.

R. C. JONES.

Jefferson, N. Y.

To the Editor of the SCIENTIFIC AMERICAN:

Market gardeners and farmers who raise asparagus for market are badly in need of a labor-saving machine for bunching the same as the work is now done by hand, the ordinary worker doing from one hundred to two hundred bunches per day.

The so-called asparagus bunchers now in use are merely iron frames, which, when filled, are pressed together by means of a lever to hold the bunch firm while it is being tied and the butt ends cut uniform.

I believe there are many among your readers who could readily devise the desired machine if they knew of its need.

The asparagus could be washed, sorted, and fed to the machine by hand.

The need of speed in bunching can be realized when it is known that the asparagus should be shipped by the late afternoon freight the day it is cut and bunched.

Freehold, N. J. C. N. BUCK.

Keeping Out Flies

To the Editor of the SCIENTIFIC AMERICAN:

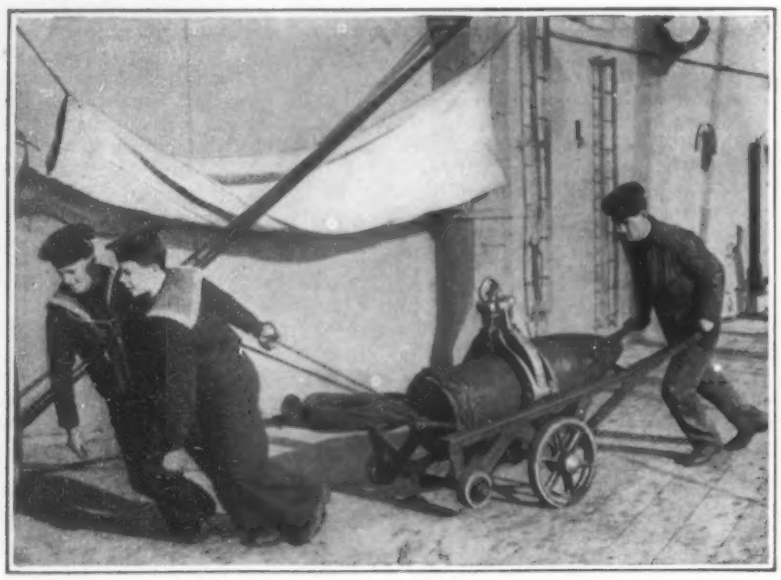
The following is the very best method to keep house-flies out of a restaurant, drug store or room of any kind; a fly will not cross the barrier, and still the door can remain open at all times.

Just outside the door, or in the entrance, place a four-bladed (wooden) ceiling fan, driving the current of air toward the floor.

The cost is about two cents per hour for the current, and a great relief is afforded from screen doors opening and closing all day. This method has been thoroughly tried out in my town.

N. M. SLOAN.

Orlando, Fla.



Transferring 15-inch shells from lighter to magazines

Transferring a 15-inch shell in the handling room

Guns of the "Queen Elizabeth"

The 15-inch Piece That Bombarded Galliopoli

OFFICIAL announcement has been made by the British Government that, since 1914, the strength of the British Navy has been practically doubled. No particulars have been allowed to transpire as to the composition of this new fleet, but it is a pretty safe guess that the increase in strength is due mainly to the building and putting into commission the large number of battleships and battle-cruisers of the super-type.

At the commencement of the war Great Britain had a large preponderance of power over Germany, particularly in dreadnoughts; but since the whole war depended on the British fleet maintaining an unchallenged command of the sea, prudence demand a sufficient increase in capital ships to offset any of those sudden disasters to which war on the high seas is always liable.

It is probable that, by this time, all the capital ships of the new program are completed and are either in commission or shortly will be so. Today, the resources of the British yards are being devoted, just as are those of the United States, to the construction of destroyers and other anti-submarine craft.

The latest capital ships of which the censor has permitted any information and photographs to be made public, are the five well-known ships of the "Queen Elizabeth" class. These ships mark a long step forward in that tendency to merge the best qualities of the battleship and the battle-cruiser in a single vessel. They are credited with a displacement of 27,500 tons, but with full equipment of fuel, stores, etc., their displacement is probably nearer 29,000 tons. The class takes its name from the "Queen Elizabeth"; the other four are the "Warspite," "Valiant," "Barham" and "Malaya."

The "Queen Elizabeth" is familiar to the public because of the part which she played in the Dardanelles campaign, when she engaged in a long-range, indirect-fire bombardment of the Turkish forts commanding the Straits.

The "Warspite" it will be remembered, got into difficulties when she was engaged with the ships of the German fleet in the Battle of Jutland. Her steering gear was jammed, and she circled in toward the German line and was for some time the target for the heavy gun fire of half a dozen German ships. She straightened out the difficulty and resumed her place in the line with surprisingly small damage. Although no particulars as to their armor have been made public, it is certain that these ships must be well covered. The survival of the "Warspite," is sufficient proof of that; for the German fire was very accurate on that day. The "Queen Elizabeth" is reported to carry 13 inches of armor on the belt, turrets and barbettes.

The two notable features in the "Queen Elizabeth" are the armament and the speed. In these ships a new type of gun, the 15-inch, 40-caliber piece, first made its appearance. Eight of these are carried, four in two turrets forward and another four aft. The secondary battery consists of 16 six-inch guns, half a dozen anti-aircraft guns, and several 12-pounders. She has four submerged torpedo tubes, firing the 21-inch torpedo.

The "Queen Elizabeth" has a rated speed of 25 knots, which is remarkably high for a battleship—in fact, at the time these ships were built it practically placed them, so far as speed is concerned, in the battle-cruiser class. They are turbine-driven, and some of the ships, on trial, reached a speed of 26 knots and over. Their high speed stood them in good stead in the Battle of Jutland, but not quite good enough. Could they have made a knot or two more, they would have steamed in column with the British battle-cruisers, and, theoretically, Beatty would have wiped out the battle-cruiser squadron of the Germans.

The 15-inch gun is the most powerful piece afloat today in any of the world's navies; although it will be outclassed by the 45- and 50-caliber, 16-inch guns which are being built for our latest dreadnoughts. It is 50 feet in length, weighs 85 tons, and with a charge of 380 pounds of cordite it delivers its 1,920-pound shell with a muzzle velocity of 2360 feet per second and a muzzle energy of 83,500 tons.

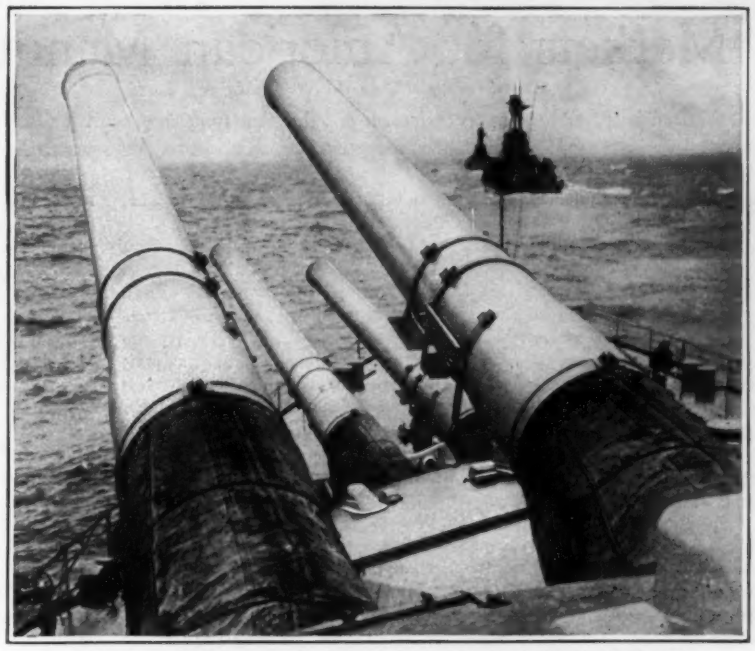
It will be noted that the velocity, judged by our standards, is low; for our own naval 16-inch gun has been designed for a muzzle velocity of 2,800 foot-seconds. The lower velocity of the British guns was adopted largely with a view to preventing rapid erosion. High velocity means high pressure and consequent high temperature of the powder gases, and high temperature means rapid erosion. By lowering the velocity and in-

Displacement 27,500 tons. Speed 25 knots. Armor: belt and barbette, 13-inch. Armament: eight 15-inch, sixteen 6-inch

The "Queen Elizabeth" steaming in column

creasing the weight of the shell, it is possible to obtain at given ranges equal penetration to that obtained by using a lighter shell with higher velocities. The British Cordite, because of its partial content of nitroglycerin is a much hotter powder than our own all-nitrocellulose powder, and consequently we can obtain higher velocities without a corresponding increase of erosion.

It is understood that the British have built some 18-inch guns and have installed them on one or more of their latest capital ships. This piece, of course, exceeds anything built or now under construction. Its shell must weigh approximately three thousand pounds and its energy, even if moderate velocities are used, will be enormous. Whether this huge piece will be permanently adopted is yet to be determined.



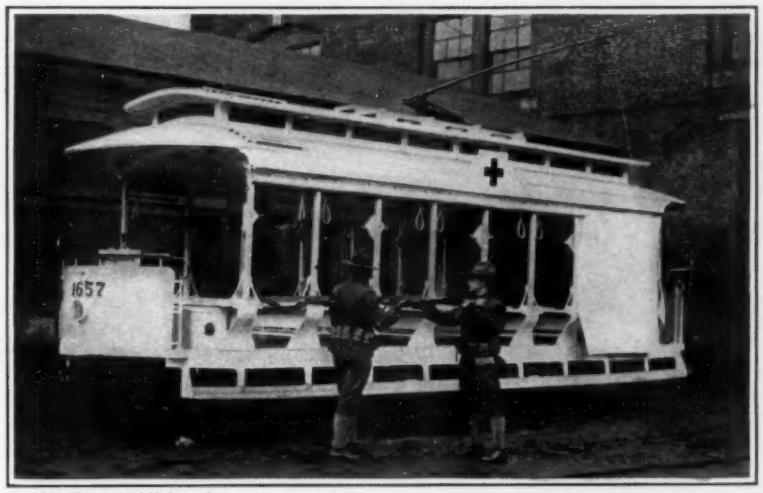
The forward 15-inch guns of the "Queen Elizabeth," trained ahead

A Trolley Car Which Became an Ambulance

TO the city of Boston belongs the credit for turning out our first trolley-car ambulance. This novel ambulance, and perhaps many more like it, is intended for use in getting wounded men arriving at seaports to base hospitals.

As will be noted by studying the accompanying illustration, the latest type of ambulance is simply a converted open car. The backs of the seats have been removed and in this manner there is room for 16 hospital litters and 16 patients able to sit up. Side curtains are provided for use in inclement weather.

The trolley-car ambulance was designed by Superintendent John Lindell of the Boston Elevated Railroad at the suggestion of Brig. Gen. John A. Johnston. Colonel Staub helped work out the details.



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Trolley-car ambulance designed for transporting our wounded from seaports to nearby base hospitals

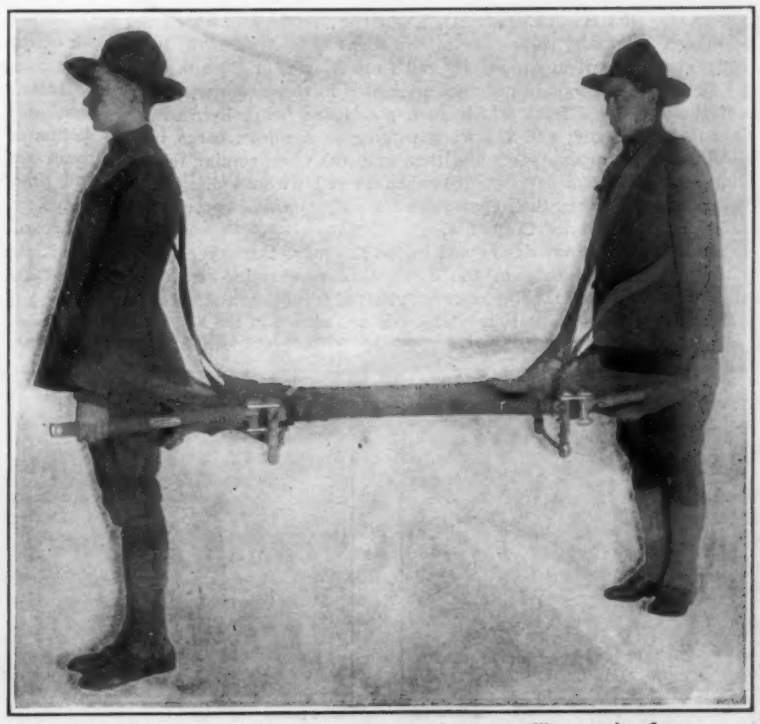
Membranes Made from Skins of Mould

AN interesting account of the making of membranes from films or "skins" of micro-organisms (bacteria, moulds, etc.), grown on suitable substances, such as "mash" is given in the *Neueste Erfindungen und Erfahrungen* (Vienna). The "skins" are first washed in water and the excess of water is then pressed out. They are next either directly treated with oil or placed in an emulsion consisting of oil and an albuminous solution. Good results are obtained from the use of linseed oil and animal glue. To prevent brittleness it is advisable to add a small amount of a non-drying oil, such as liquid vaseline, to the linseed oil. In preparing the emulsion a few drops of an alcoholic potassium linseed oil soap are added to the substances to be emulsified; the mixture is warmed and then thoroughly stirred or shaken. The addition of the soap ensures a very fine emulsion. The flexibility of the skins is enhanced by the addition of a little glycerine to the emulsion; or, to avoid hygroscopic action, a solution of a mild soap may be substituted for the glycerine. After the oiling, or a brief stay in the emulsion, the skins are wiped off and dried in the air. If desired a thin coat of varnish may then be given to the membranes thus obtained—linseed oil varnish, for example, in order to make them entirely non-sensitive to water.

To obtain very light thin membranes, which are nevertheless both gastight and possessed of considerable tensile strength, the skins are subjected to a mercerizing process before being oiled or placed in the emulsion. The thickness of the membranes may be increased by lengthening the duration of the growth of the micro-organism cultures; or several membranes may be made to adhere to each other. While these membranes possess a considerable degree of firmness, this quality may be enhanced if desired, by combination with a suitable textile fabric in the usual manner.

Tests That Point to Tin Saving

A LONG series of tests, made by a technical committee representing the National Canners' Association, to determine the relative value of different weights of tin coating on canned food containers, was recently completed with interesting results. The purpose was to determine whether extra heavy tin coating of cans would overcome rusting and perforation with different foods during storage. Seven different weights of coating were tested, ranging from 0.90 pound per base box of tin to three pounds, and these containers were used for a wide range of products, including corn, tomatoes, peas, fish, milk, apples and cider. The most significant fact established by the investigation was that none of the difficulties encountered in 12 experiments of food in plain cans was taken care of or eliminated by heavy tin coatings. These difficulties were perforation of cans in certain classes of food, unnecessarily large amounts of tin in contents of other canned edibles and discoloration of cans or of contents in many additional cases. Nor was the heaviest coating sufficient to prevent rusting under poor storage conditions, whereas with good storage conditions the slightest coating of tin was sufficient. The conclusions of this committee have a war-time significance—by further research into causes of defects in canned goods it will be possible to overcome them otherwise than by the use of heavy tin coatings on containers, which now seem to be no remedy for such troubles. By careful storage of canned goods it might be possible immediately to conserve tin through the use of lighter coatings on some types of container.



The swivel-end stretcher that goes around a corner like a train of cars

Emergency Fodder

SUBSTANCES ordinarily classed as roughage and now much used for adulteration of fodder in war-ridden Germany are ground straw, pea-pods, lichen meal, and even wood meal. Vegetable ivory nuts (*Phytelephas macrocarpa*) possess considerable nutritive power, as proven at the Massachusetts Agronomic Station, since though lacking in starch it contains other hydrocarbons in proportions of 74 to 77 per cent, besides 4 to 5.6 per cent of protein and 6 to 8 per cent of cellulose. The annual shoots of heather and reeds cut just before flowering, then dried and ground are also used for fodder. "Condiments" or appetizers used to make mixtures more attractive are salt, molasses, and the old seed of the umbelliferae, such as coriander and parsley.

While France has not been reduced to similar straits even there the general food stringency caused the Minister of Agriculture to issue a circular last July recommending the following substitutes for ordinary feed: broad-beans, kidney beans, buckwheat, rice, millet, sorghum, chestnuts, honey-locust, grape pulp, apple pulp, heather, broom, mistletoe, twigs, leaves and shoots of grape vines, fruits of the cucurbitacea, reeds, scraps of skin from tanneries, fish meal, horse chestnuts, the contents of the haunches of animals. It is advised, however, that such substitues should be used in proportions of less than one quarter of the normal ration.

Saving Shoe-Blacking Tins

IT is estimated that more than 1,000,000 cans of large capacity will be saved yearly by the Blacking and Cement Manufacturers' Association, recently organized in Boston. These manufacturers make blacking and cement for the shoe industry, and their products are put up in large tins, ranging from five gallons upward. More than forty concerns have come together under the Committee on Public Safety of Massachusetts, and are making a charge for all containers, such as cans, jugs, kegs, and half barrels, this charge to be credited the customer upon return of container. This gives an incentive to return tins, which have heretofore been used once. Each manufacturer belonging to this organization is given an identification number to be stamped on his containers.

A Stretcher that Will Turn a Corner

WE recall a problem in our calculus, our inability to solve which in a hurry almost cost us the proud rank of prize mathematician of the Freshman class, and which read about as follows: a passage eight feet wide opens out of a passage 12 feet wide. Neglecting the width of the girder, what is the longest girder which will go around the corner?

In carrying wounded men on stretchers through intricate trench systems, this identical problem arises; and if the stretcher happens to be too long, as is frequently the case, the consequences are serious. It is out of the question to lift a "grand blessé" off and on the stretcher several times in the course of a trip to the first line hospital, so the only alternative is to hoist him clear of the trench for a moment, and negotiate the turn with the stretcher and its occupant exposed to the enemy fire.

An American army doctor has come to the rescue with a swivelled-end stretcher which will take a sharp corner in three segments, and thereby obviate this difficulty; and we understand that his clever invention has been officially adopted for use in France.

World Markets for American Manufactures

Conducted by WILLIAM W. SNIFFIN

A department devoted to the extension of American trade in foreign lands

Growth of Railroads in China

CHINA has an area of about 4,300,000 square miles—about one and a half times the area of continental United States, exclusive of Alaska. Its population is estimated to be about 400,000,000. In all this vast extent of country and with this great population there were in 1916 only some 6,000 miles of railroads. Something over 2,000 miles more are under construction and still eight or nine thousand more are projected. About half the 6,000 miles actually constructed are owned by the Government and the rest by the Provinces and by private concerns.

Lack of money from the various powers that formerly assisted it so materially has been the greatest obstacle in the way of China's railway expansion in the last year or two. American capital represented by the Siems-Carey Railway and Canal Co. entered the field of railway construction in China in 1916. This company was allotted 1,100 miles of lines in various sections of the country, some of which has since been substituted for other lines. The activity of this company has been practically the only railway building in China of late, although many improvements on other lines have been made.

The development of railways in China has brought with it an increase in modern rolling stock and accommodations. During the calendar year 1915 (the latest available data thus classified) the value of railway carriages, wagons, locomotives and tenders (together with tramcars, which are included in the statistics) was $1,637,545, which was furnished by foreign countries in the following proportions—Russia 65 per cent., United States 15 per cent, United Kingdom 14 per cent, Japan 5 per cent and others one per cent. Railway materials, including sleepers, were supplied during the same year in the following proportions—Japan 48 per cent, United Kingsom 30 per cent, United States 12 per cent, Russia 6½ per cent and others 3½ per cent. The total value of these imports was $2,112,166.

The extent of the import trade in railway materials is also further shown by the following figures:

Materials	Quantity		Value	
	1915	1916	1915	1916
Railway and street cars	....	....	$355,815	$443,650
Locomotives and tenders	....	....	1,073,824	11,750,942
Sleepers (number)	1,694,001	1,746,571	952,847	1,552,874

Among the principal roads owned and operated by the Chinese Government, the increase in the 1916 receipts over the 1915 figures was as follows: Peking-Hankow line, $4,000,000 (Chinese currency, with Chinese dollars equal at that time to about $0.63 United States currency, an abnormally high rate of exchange); Peking-Mukden line, $2,300,000; Tientsin-Pukow line, $2,400,000; and the Peking-Suiyuan (an extension of the Peking-Kalgan) line, $400,000. The first, second and fourth of these lines have been very remunerative practically since their completion, but the third, owing largely to political conditions, has lost money steadily. Another line—the Shanghai-Hangchow-Ningpo Railway—reported that its income from freight in 1915 amounted to $562,549 Mexican, which was somewhat below the estimated amount—a shortage said to be due to the falling off in imports of foreign goods as a result of war prices, to the suspension of train service for a considerable period of time and to an increase in taxes on rail freight.

Other important lines in China are the Supingkai-Chongchiatun Railway from Chengchiatun, Manchuria, to Kailu in Eastern Mongolia; the Yunnan Railway, of whose total length of 534 miles only 289 miles are in China; the Shanghai-Nanking Railway, which is united to the Shanghai-Hangchow-Ningpo Railway by a junction line 10¼ miles long forming a loop around Shanghai; and the road from Honan in the Province of the same name, connecting with the Peking-Hankow trunk line and then continuing eastward via Kaifeng to the Tientsin-Pukow line. The Siems-Carey Railway and Canal Co. will construct roads in a number of different routes; among others are lines from Hunan Province to Kwangtung Province, 626 miles; the Chouchiakou-Hsiangyang route from Honan Province to Hupeh Province, 225 miles; a line from Hsinyangchou (Honan) to Hupeh Province, 277 miles; and several other routes on which only preliminary surveys have been made.

The opportunity for the United States to grasp the trade involved in supplying and maintaining these railroad routes is evident and several competitors appear to be out of the field, at least for some time to come. The American trade is already noteworthy and can be increased very largely.

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An up-to-date train on the Manchurian railroads

Restriction of Imports Into the United States

IN pursuance of the power vested in the President on February 14th, 1918, by the Trading-with-the-Enemy Act and by him delegated to the War Trade Board, that body on March 22d issued the first list of articles the importation of which into this country is forbidden. The articles are classified as non-essential commodities and restrictions in their import will, it is estimated, represent a saving of 250,000 tons of shipping to the fleet now employed in carrying troops, munitions and foodstuffs abroad. The embargo is intended to apply principally in the shipping between this country and Europe.

Importation of the articles named in the restricted list is permitted: (1) When the articles mentioned are actually shipped from abroad prior to April 15th, 1918; (2) when coming by rail from Mexico or Canada when the goods in question originated in those countries or in others from which such goods are being licensed for import; and (3) when coming as a return cargo from European ports and then only (a) when coming from a convenient port, (b) when loaded without delay, and (c) when the importation from Europe is not specifically prohibited in the list.

The articles named in the list may, therefore, be imported only in the exceptional cases indicated. The importer is not, however, relieved from the need of securing a license to import goods not named in the list, since all articles imported now require a license. Among the 82 articles specified in this list are agricultural implements and certain foodstuffs, articles of luxury, minerals, chemicals and liquors.

Embargoes are not new in the history of the United States. The policy was first used in 1794 in retaliation for hostile acts in restraint of American trade by Great Britain. The most famous application of such an act, however, was during the administration of President Jefferson, when the Embargo Act of 1807 was passed. All American vessels, by this law, were prohibited from sailing for foreign ports, all foreign vessels from taking out cargoes from this country, and all coasting vessels were required to give bonds to land their cargoes in the United States.

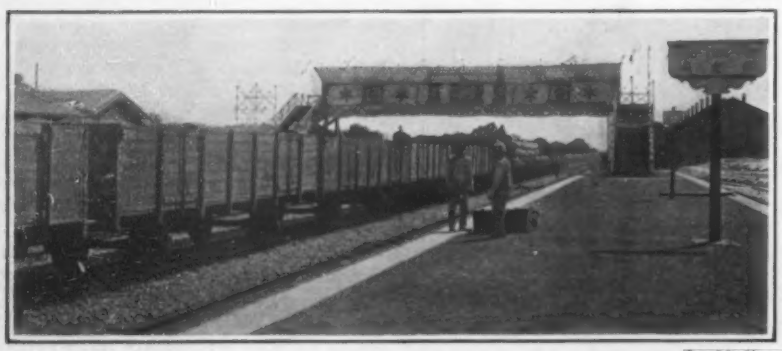
The Embargo Act was passed in retaliation for the various British orders in council and Napoleonic decrees, by which Great Britain and France each sought to prevent all neutral trade with the other. With a foreign trade that employed 700,000 tons of American shipping alone, Congress thus passed a law declaring an unlimited embargo, for all purposes of foreign commerce, on every port of the Union and thereby anticipated a large portion of the injuries that were expected from an open enemy by inflicting them on itself

It is true, the embargo was constantly evaded by smuggling, by permits from the governors of the states, by ballast licenses from the president, and in many other ways. It was not long moreover, before complaints were voiced against the Act, which bore with as great severity on this country as on England. Each country was aware of the suffering and injury to the other and the situation became in fact a trial between the two as to which could endure the longer, despite the disadvantage that the United States lay under of having deprived Great Britain of the trade of only one nation, while we had deprived ourselves of the trade of all.

Certain sections of the United States were so seriously affected by the trade restriction that, it is said, practically all trade ceased and grass grew in the streets of the great Atlantic seaport cities. In February, 1809, John Quincy Adams, who was then, a senator from Massachusetts, resigned from his seat in Congress owing to differences of opinion with the Massachusetts legislature regarding the Embargo Act. At the same time he wrote to President Jefferson that "from information received by him, and which might be relied on, it was the determination of the ruling party in Massachusetts, and even New England, if the embargo was persisted in, no longer to submit to it, but to separate themselves from the Union, at least until the existing obstacles of foreign commerce were removed." The danger thus threatening the Union was deemed paramount to all other considerations, and the President concluded that it would be better to modify this interdiction of commerce in such a way, that while employment was afforded to American vessels, Great Britain and France should still feel the loss of American commerce.

Accordingly Congress on February 27th, 1809 repealed the Embargo Act as to all nations except France and Great Britain, and "interdicting with them all commercial intercourse whatever, whether by exporting or

(*Concluded on page 351*)



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Modern freight equipment, showing also the foot bridge for crossing tracks

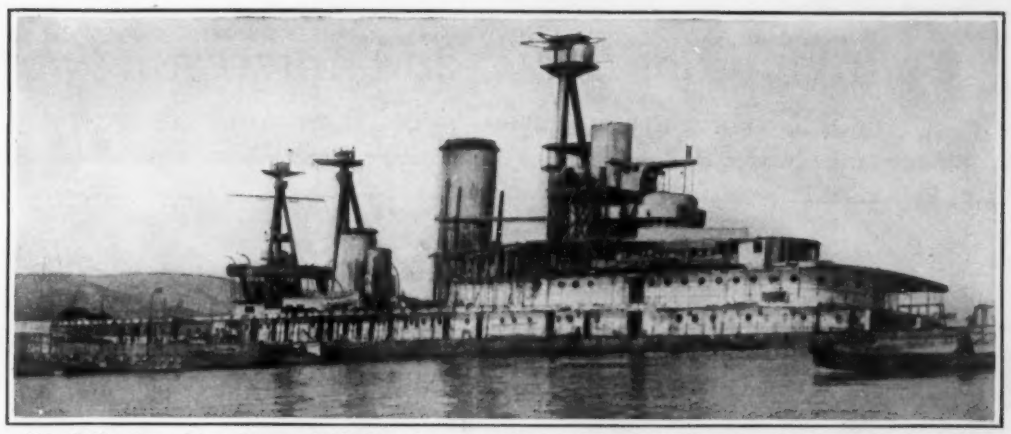
Type of passenger cars for the coolie class of passengers

Dummy Dreadnoughts of the British Fleet

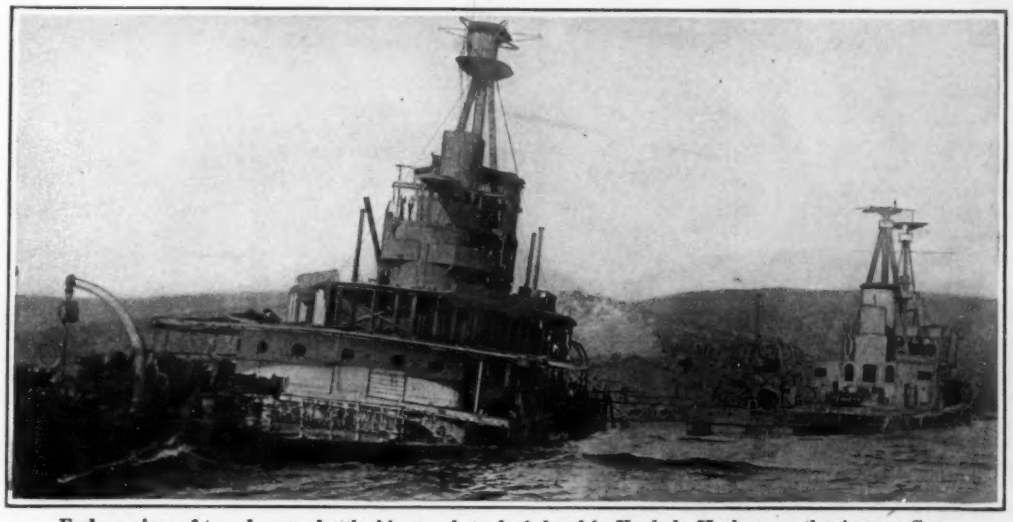
BY the use of dummy battleships the British fleet succeeded in deceiving the German naval forces for a period of several months. Indeed, it was the sagacious manouvering of a British squadron of dummy battleships mounting dummy guns which deceived the Germans for quite a while in the North Sea, and finally decoyed them into the Dogger Bank battle which ended rather disastrously for them. Dummy battleships were also employed in the naval operations against the German and Turkish forces in the Dardanelles, with presumably good effect. But now that the dummy battleships have served their purpose and the Germans are in on the amazing and jealously guarded secret of the existence of such a fleet, they have more or less lost their value. After all, such a *ruse de guerre* has a very limited life; its success must be achieved early in the game, otherwise it is doomed to failure.

The two accompanying photographs of dummy dreadnoughts of the British fleet are of interest in that they show what is perhaps, the most remarkable kind of camouflage yet undertaken. By providing steamers with wooden and canvas covers, the British camoufleurs succeeded in securing the general outlines of well known capital ships of their navy. Guns, turrets, tripod masts and other features were represented in convincing enough scenery.

By making use of dummy battleships the British obviously gained a tremendous advantage. While the prototype was doing service elsewhere, the sham battleship was exerting the desired effect on the enemy. As likely as not on more than one occasion the appearance of a fleet of dummy battleships discouraged the enemy from attacking, since in this war the establishment of an apparent superiority of naval forces serves as a check to the enemy, who does not attempt battle in the face of such evident odds.



Broadside view of two dummy battleships in more or less wrecked condition, showing the steamer architecture beneath the camouflage

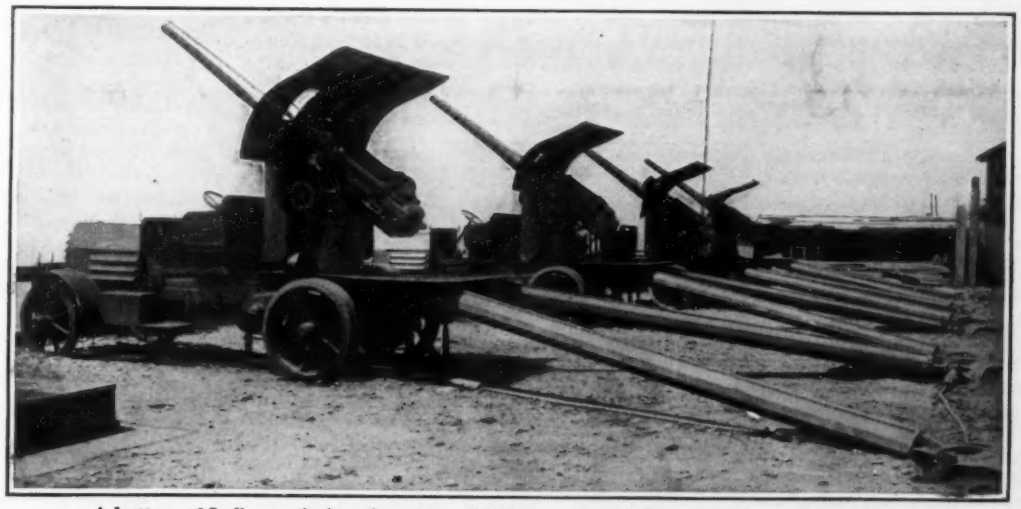


End-on view of two dummy battleships sunk to deck level in Kephalo Harbor, on the Aegean Sea, and used as breakwaters

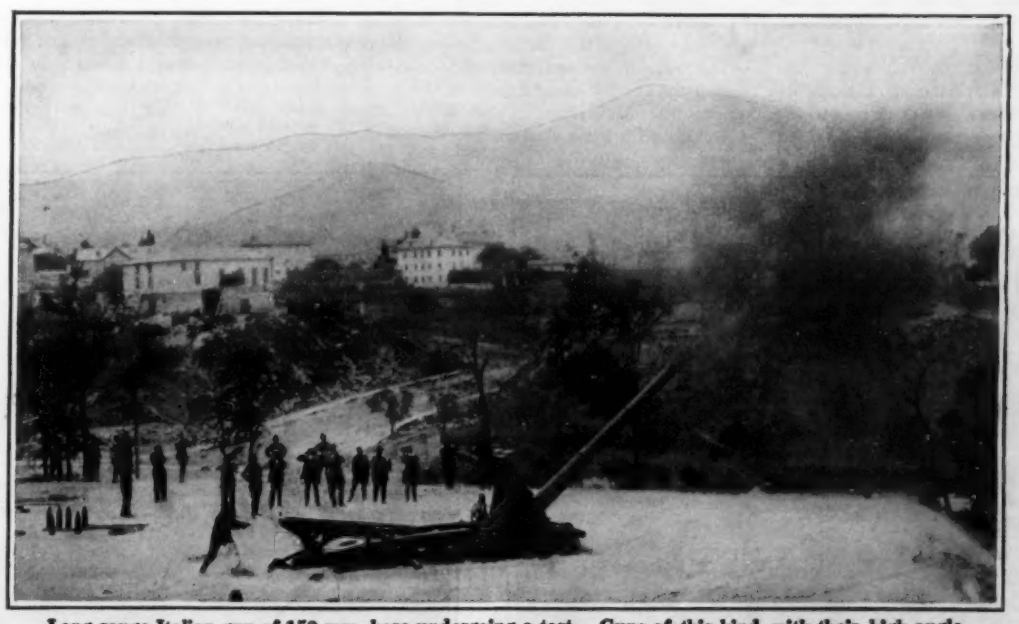
Guns of Our Italian Allies

REGARDLESS of the general mystery connected with Italy's participation in the world-war, this much is certain: Italy entered the war with splendid artillery. Of field guns, for instance, she had the very best in the Deport rapid firer, which is said to be an improvement on the French "seventy-five." In anti-aircraft artillery, too, Italy had splendid types. However, in the matter of heavy artillery she was found wanting, just as were the other Allied countries in the first year of the war.

In the accompanying illustrations appear a battery of Italian 102 mm. (four-inch) anti-air-craft cannon and an Italian 152 mm. (six-inch) long range gun. The former, it will be observed, is a splendid type of anti-aircraft piece, mounted on a substantial motor truck which is provided with jacks and extra long limbers for taking up the recoil of discharge. The latter is a long-range position gun of a type which has given good service in the mountains, firing over lofty ranges at targets many miles away.



A battery of Italian anti-aircraft cannon of 102 mm., mounted on powerful motor trucks and provided with jacks and extra long limbers



Long-range Italian gun of 152 mm. bore undergoing a test. Guns of this kind, with their high angle fire, are excellent in mountain fighting

During the precipitous Italian retreat from Austrian territory, last fall, and the withdrawal of the Army to the Piave River the better part of the modern artillery of the Kingdom fell into enemy hands. It is conservatively estimated that some 2,500 cannon were lost; and since then the Italians have had to depend on such field guns as they still possess, long-range pieces rushed by the British and French to the Piave line, and numerous nondescript guns which long since were considered obsolete. However, the last mentioned pieces, old and inefficient, serve to fill out Italy's artillery while new cannon are being turned out.

Do Not Shoot at Pigeons

NUMEROUS complaints have been made to the Pigeon Section of the Signal Corps that carrier pigeons of the racing homer type, being trained throughout the United States for communication service with the American Army, have been shot by persons on hunting expeditions.

In spite of the fact that many States have laws prohibiting the shooting of pigeons, the killing of these birds by hunters has interfered seriously with the training of homing and carrier pigeons for Army service. It is believed that the persons responsible for the death of these birds are unaware that they are hindering an important branch of war preparation.

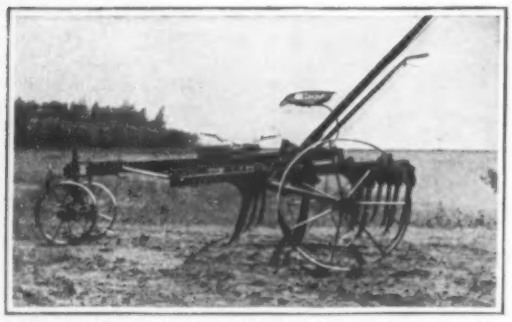
Because of the important part carrier and homing pigeons are playing in the war, and the great need for their breeding and development in this country, the War Department has considerably expanded the Pigeon Section of the Signal Corps. Homing pigeons constitute one of the most effective means of communication in the Army, and are especially valuable as a sure method of replacing other means of communication. The breeding and training of pigeons, therefore, is of paramount necessity as a war measure.

Any pigeon in the air may be a carrier pigeon flying from a loft under Government supervision. Its destruction may be a serious loss to the American Army. All persons, therefore, are urged to refrain from the shooting of pigeons and to discourage the practice of hunters and of children.

Persons coming into possession of pigeons labelled "U. S. A.—18," indicating that they are being trained for Army purposes, are requested to report the fact at once to the office of the Chief Signal Officer, Land Division, Washington, D. C.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



The little machine for taking out tough, long-rooted weed grasses

The Nemesis of Quack Grass

EVERY farmer knows that he is always sure of one crop if he wants it—and usually whether he wants it or not. That is the weed known as "quack grass", the toughest customer in the botanical world.

This grass is not particularly imposing above the ground. But below the ground each little tuft of quack grass has a tangle of hundreds of feet of roots. And there is no known vegetable substance that can increase and multiply like quack grass. It is the guinea pig of plants. Once a spear is located in the corner of a 10-acre lot, one scarcely need allow it peace for a week before it is dominant in all parts of the field.

Here is a new machine, invented and built especially to allow the farmer a better weapon against quack grass. Of course there is only one thing to do to the weed, and that is pull it up, but heretofore that has been next door to impossible, for there has been no competent tool. This simple machine is made to do the trick.

It is an array of narrow spear spades, set in a frame strong enough to allow the thin steel spears to be pulled through the toughest turf. The 14-inch spears, projecting down and curving a little forward, are set at six inches distance from each other. As they go through the turf they do not pull it up like a plow, but slide through much as the teeth of a rake slide through sand. The quack grass roots are caught by the spears, however, and are brought to the surface.

So far 300 of the machines have been sold in Minnesota and the Dakotas, and they have given such good satisfaction that the manufacturer now is establishing himself to supply a national market.

Night Goggles Safeguard the Motorist

IF you are a motorist you have probably said—or thought—unprintable things when driving at night and blinded by the glare of the headlights of an approaching car. Several accidents have been caused by collisions or running into ditches due to the fact that at least one driver was so dazzled by the intense illumination of the other motor car that he could not properly see to direct his own. To be sure, the laws in many places demand that one of the many types of non-glare lenses be installed upon every motor car abroad at night, but one often drives where no such rules exist and frequently in places where the existing rule falls far short of universal enforcement. It is one thing to comply with the law, and quite another to be embarassed by another's disregard of it.

Since many motorists are not yet observing the "Golden Rule" by using the preferred automobile headlight lenses there is available a means of protection which can be used at a very moderate cost. A recent invention of night goggles provides the remedy. The left hand portion of each lens is colored or shaded to a point reaching almost to the pupil of the eye, but not interfering with the vision when the wearer of the goggles gazes directly ahead, holding his head in its usual position. When an automobile with undimmed headlights approaches, the owner of the protecting goggles has only to turn his head very slightly, about a fraction of an inch to the right, and the rays of light from the oncoming vehicle will pass through the shaded portion of the lenses. In substance, the view of the road ahead is split in two lengthwise, with the portion directly in front

Armless man writing with his knee

Goggles that cut the glare of an approaching headlight

well illuminated by the headlights of the car driven by the wearer of the safe goggles and the other half shaded for him by the dark section of his eyepieces. A spring in the goggles adjusts them to a face whose pupilary distance may be above or below normal.

Writing with the Knee

THOSE who have lost their hands or the use of them may still, with a little practice, write legibly by aid of the knee-writer here illustrated. The clamps and clips fasten the leather sheaf firmly to the knee, and the pen or pencil to the leather. Paper is held in position before the knee on a little stand.

The knee-writer that takes a great load off the toes of armless men

The actual process of writing is not nearly so difficult as might seem. The heel is raised until the foot rests on the ball, giving the knee quite a range of action, combined with sufficient steadiness to insure proper control after a due amount of practice. There can be no comparison between this device and the writing by means of a pencil held in teeth or toes, which has heretofore been about the only resource of the armless.

The knee-writer is an invention of Dr. Arthur T. Blachly, formerly of Portland, Ore., but now serving in the Medical Officers Reserve Corps somewhere between the Pacific Ocean and the French front.

The Stereogoniometer

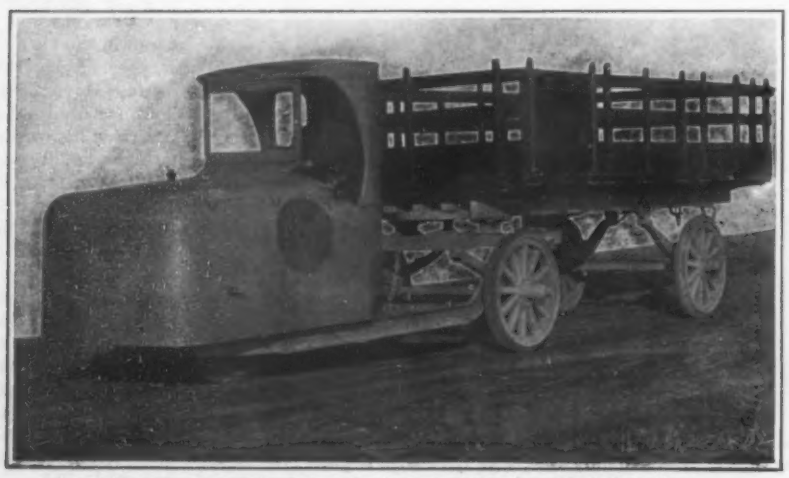
THIS is a new instrument, invented by J. Comas Sola, director of the Fabra Observatory, Barcelona, Spain, for determining the proper motion or the parallax of stars by the stereoscopic method. The inventor states that two negatives taken only 20 hours apart, with an exposure of 30 minutes, enabled him to measure quite accurately the proper motion of P. Ophiuchi.

Here Truck and Tractor Merge

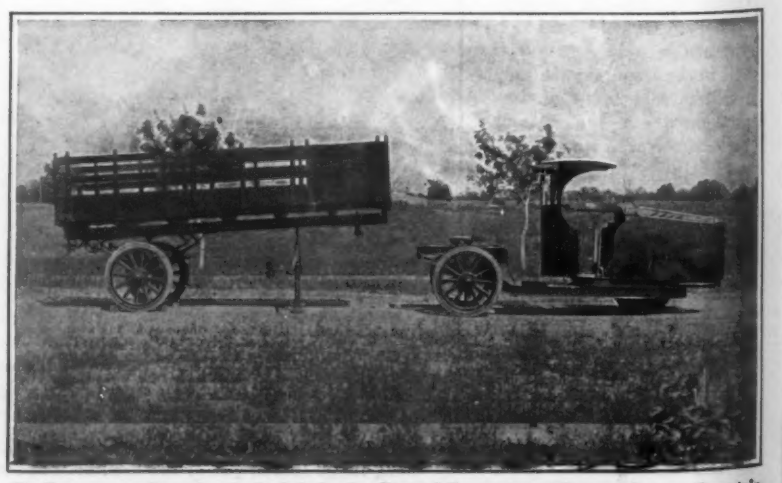
A NEW commercial vehicle being placed upon the market in 1918 combines many of the features of the truck with some of those of the tractor, enabling the hybrid to perform services impossible to either "parent" alone. It runs upon three wheels and draws its load in a trailer, which can be supported level by means of jacks and thus left for loading or unloading while the busy little power plant goes back to transport another ready load. The new motive plant, driving from its front wheel, pulls every bit of its load, as would a horse or steam locomotive, though it can push it backward if necessary in crowded quarters.

On short hauls one of these machines can care for three or four trailers, all of which, if desirable, may be of different types to suit various special kinds of loads. The adaptability of the vehicle is further increased by its ability to move around in very limited space, an advantage in a crowded freight yard or congested dock or narrow alleyway. The turning radius of this tractor, with trailer, as a unit, is only the wheelbase of the trailer, which averages 12 feet.

The semi-trailer it attached to the power plant by a ball and socket type "fifth wheel," so arranged that it can be quickly and easily disconnected. Together, tractor and trailer are prepared to do five-ton duty at something less than the cost of the usual five-ton truck and with greater adaptability. The driver's cab, when desired, can be turned directly around and made to face the load.



The new three-wheel tractor, for use with two-wheeled trailer



Trailer, propped up by jack, left for loading while power unit goes for another trip

What Pershing's Biscuit Boxes Taught a Syracuse Packing Case

CONSIDER, please, what changes have come to pass in the building of motor trucks during the two years since Gen. Pershing crossed into Mexico.

Then, Motor Truck design was thought to have approached practical perfection. Methods were thought standardized for years to come. Engineering practice was considered settled.

Then, certain truck troubles were thought inevitable—breakage, periods of idleness for replacements, rather rapid depreciation—all were thought quite natural, or blamed on the driver, who would overload.

Then, people talked quite glibly of the limitations of motor hauling—how they might or might not be suitable for local delivery purposes, but could never be a serious factor in the real transportation of the country. And even the builders believed them.

And Then came Pershing. Into the melting pot of military service were poured a half-hundred trains, 27 to 33 trucks each—a great symposium of America's best—and the supreme test of feeding a moving army hundreds of miles from its base.

Almost in a day old standards of truck building and truck service were swept away. Now, all truck designers know that the old trucks engineered for carefully graded hauls over paved roads only, can not meet the needs of this day and generation. Now, all motor truck engineers know that the old truck troubles, the breakdowns, the endless repairs, the losses of time, the faults and weaknesses thought inevitable, are 95 per cent avoidable. They were not the faults of owners and drivers; but fundamental faults of engineering and design.

NOW, the whole world knows that there is no reasonable limit to the functions of the motor truck The day of the long haul is here. Motor transport is the salvation of America's industry facing transportation chaos.

Pershing's Biscuit Boxes have taught a new lesson in economy of transportation to the packing case of Syracuse, New York, Chicago, and the rest of the world. Out of the Mexican military expedition came a new truck—the WINTHER.

Model 28 Maximum capacity 1 ton
Model 48 Maximum capacity 2 tons
Model 68 Maximum capacity 3 tons
Model 88 Maximum capacity 4 tons
Model 108 Maximum capacity 5 tons
Model 128 Maximum capacity 6 tons
Model 148 Maximum capacity 7 tons

Winther Motor Truck Company

Winthrop Harbor ***Dept. H*** ***Illinois***

Applying fully to commercial use, the lessons of that military expedition, these trucks are built in a new factory, by men rich in truck experience, backed with ample capital, with neither traditions nor policies to be protected, to meet the service all trucks now must yield.

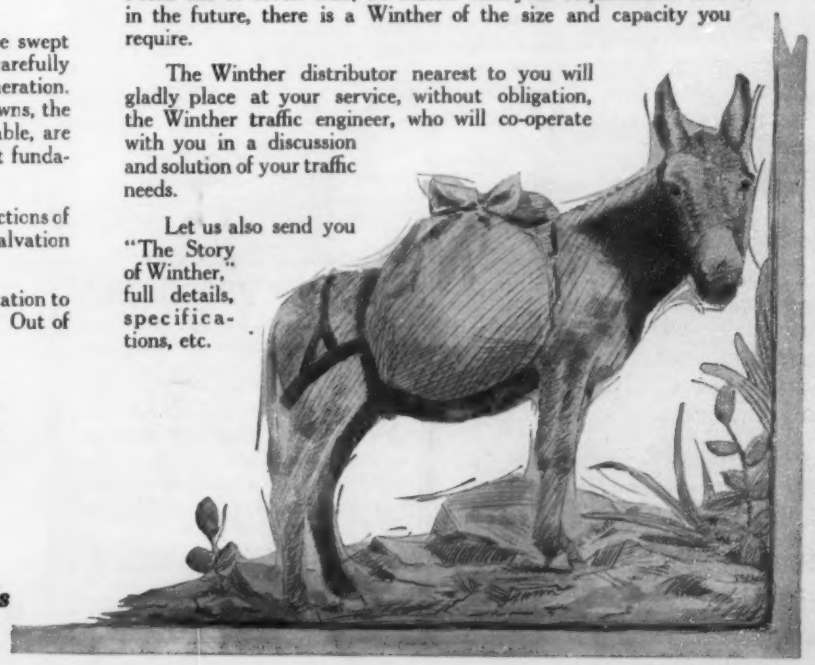
Winther has established new standards of motor truck construction, new standards of economy and long life.

Winther Internal Gear Driven Trucks are not an experiment. They are used from Coast to Coast. The statement of their service is based upon the experience of their users. They are not cheap trucks. A mere recital of the materials entering into their construction would serve to convince even the layman of their quality. No fundamental change has been found necessary in their building since the first Winther took the road. A complete engineering investigation of every Winther now in service in the United States, finished March 1st, failed to produce a single suggestion for their betterment.

There is a Winther Truck for every high-grade truck need. From one to seven tons, no matter what your requirements now or in the future, there is a Winther of the size and capacity you require.

The Winther distributor nearest to you will gladly place at your service, without obligation, the Winther traffic engineer, who will co-operate with you in a discussion and solution of your traffic needs.

Let us also send you "The Story of Winther," full details, specifications, etc.



The Current Supplement

THE control of Asia, outside of the portions dominated by Russia, has been a matter of serious consideration by many European governments for hundreds of years, as it includes a region of vast riches and probably the most desirable field for commercial development in the world. The recent happenings in Russia, and the campaigns in Palestine and Mesopotamia are intimately linked with this problem. Some of the doings of the British in these regions are the subject of an article entitled, *The Gates of Asia* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 1106, for April 13th. The illustrated paper on *Mediaeval Choir Stalls* is concluded in this issue, as is also the valuable paper on *Developments in Alternating Current Work*. A short note on *The "Ship of the Desert"* calls attention to the valuable transportation work that is being performed by camels for the forces in Palestine, in places where wheeled motor vehicles cannot be operated. It is accompanied by a striking photograph. The article on *The Museum of the American Indian* gives interesting information about one of the new and notable institutions in the City of New York, which is soon to be opened to the public. A number of striking illustrations accompany this article. A fitting companion to the foregoing is an article on *The Peopling of the American Plains by the Indians*, which gives a probable interpretation of known facts. *A Table d'Hote Tree* tells of some remarkable feats of grafting by which a number of fruits and flowers have been made to grow on a single trunk. A photograph shows this unique tree. *The Dufay Versicolor Process in Color Photography* describes a recent interesting development in the production of colored pictures. *Unsinkable Ships* discusses some systems of construction that have been proposed, and describes an ingenious new method.

How Wireless Helps the Mariner

(Concluded from page 340)

charging unit as a source of power. The apparatus is entirely automatic and requires practically no attention. All that is required to start the apparatus is to throw in the battery switch which closes the circuits for the radiphone and starts the motor driving the phonograph. The wave length used is 600 meters, which is varied by a specially designed variometer. The wave length varies continually between 550 and 650 meters.

By the use of this apparatus any ship equipped with receiving set and with an ordinary operator can easily pick up the signals and round the light. The limited use of the radiophone along the coast makes the warnings very positive and unmistakeable. Even though an operator were not listening for the signals, he would immediately recognize them as there are no other radiophone signals on the Atlantic Coast. The receiving apparatus is so small and requires so little tuning that for small ships with no operator, the Captain with a few minutes instructions could pick up and use the signals. On ships equiped with radio compass bearing could be taken and positions plotted without seeking the lighthouse.

The first set of this type has been installed at the Lighthouse on Point Judith, R. I., the western approach on Narragansett Bay. After this set has been in operation for a few months and service data obtained, it is the intention of the Navy Department and the Department of Commerce to place radiophones on several of the Lighthouses on the Atlantic and Pacific Coasts.

Vivisection of a Condemned Building

(Concluded from page 341)

years life of the building, reached its full ultimate strength. The maximum deformation was 1.1 inches.

The value of these tests consisted not merely in showing the strength of the floors, but also in showing how the stresses were distributed throughout the floor and what proportions of the load were taken by the various bar systems. The fact that the floor did not fail under a load that is almost four times as great as that which the city of Chicago permitted to be placed on it—250 pounds per square foot—shows that the construction was exceptionally strong. Although incipient failure resulted, Prof. Talbot estimated that a load of 1,500 pounds per square foot would have been necessary to produce complete failure. It was Prof. Talbot's opinion, however, that it would be of greater value to watch the recovery of the floor after the removal of the pig iron than it would be to cause complete failure of the slab. It was for this reason that strain gage readings were taken after the full load had been in place for some time and again after the pig iron had been entirely removed.

It is interesting to note that the highest stresses occurred around the column caps and not at the center of the panel. The negative bending moment was responsible for the incipient failure of the concrete around the column caps.

The steel reinforcing rods were uncovered by means of bull points and hammers. The readings were taken with strain gages which were graduated to read directly the stress corresponding to the deflections.

Strategic Moves of the War

(Concluded from page 342)

an enemy could be dealt with at any time. The strongest sections of the present British lines are from Arras down to Albert and the Somme River and of the French lines from Lassigny to Noyon and the Oise. The Germans have thus been forced into a channel running straight to Amiens; the Allied task has therefore been much simplified and made easier.

The latest news from Italy records the distribution of 40 new Austrian divisions along the Italian front; this move has convinced the military leaders in Italy that the struggle in France will not prevent a strong offensive against the Italians lines. It is therefore believed to be impracticable to transfer any of the French and British troops now in Italy to reinforce the western front where the Germans are pressing so hard to break the Allied lines. All available Austrian artillery has also been brought from the Russian and Rumanian lines to the Italian front. The Italians are therefore preparing for the final blow that may have been postponed by the battle in France but which must in the near future be met by using every available man and gun to stem the hostile tide.

Strong lines have been constructed along the Piave River and on the northern front, the Italian troops manning them are in prime condition, and they still have had appreciably the support of the British and French forces that were sent to their aid after the disastrous retreat from the Carso and the Isonzo River. It appears to be the opinion of the Allied staffs that the Austro-German offensive, when developed, may branch out around both sides of Lake Garda, the western movement taking place down the Giudicaria valley from Trent, in the direction of Brescia and the other on the eastern side from Trent down the valley of the Adige having Verona as its ultimate object.

If these surmises are correct, then it is the intent of the Central Allies to drive back the armies now protecting Lombardy and to turn the left flank of the forces defending the lines from the lower Piave up that river and along the mountain fronts. If such a move should be successful, it would strike a hard blow at the industrial centers of northern Italy and would render it almost impossible to continue the present manufacture of munitions in Lombardy and Piedmont.

Strategically a successful drive on Brescia, leading to an Italian defeat, would render it possible for an Austro-German army to make an attack on southern France through Italy; a breaking of the Italian lines on the north would put Italy out of the war. On the Piave lines the one serious possibility would be the capture of Vehice; the fall of the city, while having no military value, would however have throughout Italy a tremendous moral effect since it is known that if it fell into the hands of the Central Allies, it would undoubtedly be practically destroyed.

The British forces that won a striking

victory on the front along the Euphrates River in Mesopotamia have recently overwhelmed and cut to pieces the entire Turkish force in the area around Hit, the scene of their former success. They have advanced more than eighty miles north of Hit and have captured a large number of prisoners, guns, ammunition and stores. Except for distance, the way now seems clear for any advance up the river that may be deemed advisable in order to threaten Aleppo and the Bagdad railroad. It is apparent that it is toward these two objectives that the British advance is directed.

In Palestine it is stated that mounted troops have destroyed several miles of the Hedjaz railway. This cuts the communications of the Turks with any of their forces that are in the country southeast of the Dead Sea and with those in western Arabia. In the latter country, the revolting Arabs have already taken parts of this road; but the destruction further north at the points indicated by the British will prove a far more serious blow to the Turkish forces. The only rail route to the Mahommetan holy cities of Medina and Mecca has also been destroyed by the British stroke.

American Elephants

THE submarine danger and the use of ships for war purposes have lessened the commerce between the United States and Africa to a great extent in the past two years. The supply of many of the products formerly imported from the African countries by this nation has been decreased considerably and in some cases has ceased entirely. Naturally the users of these products have been compelled to find substitutes of American make if they wished to continue the use of these articles.

One of the chief imports from Africa in the pre-bellum days was ivory, the product of the elephant. The boudoir of many of the ladies of the land contained many ivory toilet articles, the piano sported its ivory topped keys, and many other uses were made in this country of the product of the tusk of the elephant.

With no ivory being imported, and having no elephants in this country, Americans were compelled to find a substitute. Old King Cotton came to the rescue, offering a means of producing artificial ivory that possesses all the beautiful qualities of the real article. A cotton solution chemically treated by several processes changes the raw product of the Sunny South to a hard ivory-colored substance that can be easily moulded into any shape desired. Manufacture and sale of this material as an ivory substitute have reached large proportions.

Restriction of Imports Into the United States

(Concluded from page 346)

importing, either directly or circuitously." This measure was known as the Non-Intercourse Act. The limitation involved in this Act on trade with France was ended on November 2d, 1810, by President Madison, after Napoleon had annulled his decrees affecting American trade. The restriction with Great Britain was settled with the War of 1812.

Happily the wisdom of the present decree is thoroughly appreciated and understood by all Americans, and patriotism and expediency combine to induce its acceptance as a wise and necessary war measure. It is true, the effects of the order will undoubtedly concern those whose imports have already been cut down in rather large proportions and whose outgoing cargo space has been limited; but, in general, it will not have any very severe effects upon industry, and the authorities state that legitimate and necessary business will be interfered with as little as possible.

Cactus Alcohol

THE newest use for Southwestern cactus is as a source of alcohol for industrial purposes. With the crudest sort of stills, Mexicans have made beverage alcohol from cactus for many years. Cactus alcohol would conserve corn and other grains. A concern in Louisville, Ky., is now looking into the possibilities of this waste-land crop.

NEW BOOKS, ETC.

TIMBER FRAMING. By Henry D. Dewell, Assoc. M. Soc. C.E. San Francisco: Dewey Publishing Company, 1917. 8vo.; 275 pp.; illustrated. Price, $2.

"Timber Framing" embodies the results of 11 years' experience and is a compilation of valuable information based on practical results. The literature of timber framing is all too scant, particularly in details of design; the author has followed his designs into the field, has carefully tested various types of timber joints, and is thus often able to simplify the work of the carpenter while retaining all effective features. He establishes working-values that will prove most useful to the structural engineer and his treatise is a distinct contribution to a subject that has been somewhat neglected by technical publications.

TOPOGRAPHY AND STRATEGY IN THE WAR. By Douglas Wilson Johnson, Associate Professor of Physiography in Columbia University. New York: Henry Holt and Company, 1917. 8vo.; 223 pp.; with illustrations and special maps Price, $1.75 net.

A theater—now-a-days, at least—presupposes scenery. Professor Johnson takes us to each of the more important theaters of war and shows us how the scenery, the physical conformation of the country, influences the drama there enacted. In the past, natural barriers such as rivers, mountains, deserts and seas vitality affected the outcome of military campaigns. Now, however, that high explosive shells are hurled with accuracy over mountain tops and our scouting airmen can discover every important movement of troops, the question arises as to what extent military operations are still affected by terrain. After a most interesting journey to the various battle fronts and a review of what has actually taken place during the first three years of the war, the author concludes that the element of terrain plays quite as great a part today as it did in the past. The volume also meets another demand; the sketchy and often inaccurate maps alone accessible to the public are here replaced by maps that convey reliable pictures to the mind, and these will be found very useful in following the progress of the conflict from day to day, as it is reported by the press.

A LOITERER IN NEW YORK. Discoveries made by a Rambler through Obvious yet Unsought Highways and Byways. By Helen W. Henderson. With a Preface by Paul W. Bartlett. New York: George H. Doran Company, 1917. 8vo.; 454 pp.; illustrated. Price, $4.

Rarely have we seen a better example of book making, or illustrations chosen with more exquisite taste or more beautifully reproduced; interesting portraits abound, and, as to the scenic and architectural features, it would seem hardly possible to obtain such unhackneyed viewpoints for the camera. No section of the city escapes the trained eye of the author, and at last we have a dependable, competent guide to the art treasures of New York; the rich display of the work impresses upon us the indisputable truth that the New Yorker is surrounded by beautiful things—if he only knew where to look for them. The chapter on Trinity Church alone is a revelation, and leaves us amazed at the number of artistic memorials within its sacred enclosure. The City Hall comes in for a great deal of attention, as do also Greenwich Village, Washington Square, and Union and Madison Squares. If we have mentioned first the striking illustrations, it is only because they constitute the feature which first attracts the eye; but the text holds a treat in store, too; it is exceedingly well written, and to visitor and inhabitant alike it opens up a world of beauty and treasure that might otherwise easily go unappreciated.

THE BOOK OF NEW YORK. By Robert Shackleton. Philadelphia: The Penn Publishing Company, 1917. 12mo.; 377 pp.; illustrated. Price, $2.50.

Here we have another delightful book on New York city, and the name of the author, coupled with the success of his labors, reminds us that exploration may be as profitably undertaken in the centers of civilization as in the Antarctic. The work teems with interesting memories of both the old and the new city; nothing seems to have been omitted, not even the trips up the Hudson as far as West Point, and down the Bay. The author succeeds in imparting a strong literary flavor to the work, which grows with acquaintance; for example, the new Studio Buildings reconstructed from old houses in East 19th Street are illustrated, and the view of Gramercy Park from the Players' Club is very unusual. The photo-engravures, and the line cuts from drawings by R. L. Boyer, are excellent productions; one of the most attractive pictures we have ever seen is a bit of Milliken phase in old Greenwich Village, taken on a winter's day. The lights of Broadway make a striking night piece and reproduce a fairyland effect that may soon be, temporarily at least, a thing of the past. Altogether the book possesses unusually attractive features, and a distinction of treatment that should ensure its welcome among those who love their New York and would make a closer acquaintance with its artistic, literary and historical aspects.

THE MODERN GASOLINE AUTOMOBILE. Its Design, Construction, Operation and Maintenance. By Victor W. Pagé, M.E. New York: Munn and Company, Inc., 1918. 8vo.; 1,032 pp.; 1,000 illustrations, 12 folding plates. Price, $3.

The mere possession of such a work as this gives the inexperienced a feeling of confidence—a feeling fully justified, for the manual, put to the test in a thousand ways, will be found lacking in none; it is an expert always at the elbow. Addressed to the motorist, mechanic, repair man, designer and engineer, it covers all power-propelled vehicles from the cycle-car to the elephantine truck; even the war automobile is included. The 1918 edition is really a new book from cover to cover; 500 new engravings have been added, and every recent refinement receives thoroughgoing attention. The cheaper manuals flooding the market make one of two mistakes: either they assume the reader to be a child, devoting all their space to the most elementary facts, or they write for the mechanic, and their contents are Greek to the ordinary man; both errors indicate the inability of the instructor to arrange his material properly and to express himself clearly, and certainly no such shortcomings can be charged against the specialist who has given us this satisfying work, for he is the originator of the practical system of self-education. There are no technicalities that need frighten away the layman, yet those who already have a wide knowledge of the subject may still further widen and deepen that knowledge by means of Lieut. Pagé's up-to-date treatise. The timid who hesitate to buy a car from an exaggerated idea of the running expense or of the mechanical ability required will find their fears vanishing before the light that the author throws upon every phase of his subject. The 1,000 specially prepared illustrations put the X-ray upon the hidden mechanisms of the car; metal casings become transparent, and the reader soon knows more of his car's organs and their functions and diseases than the average physician knows of human organs and ailments. The diagrams are cleverly designed to show vital conditions at a glance. For example, take the important question of fuel; you fill the tanks of your touring car and start to travel 40 miles an hour on direct drive; how much of the fuel value gets to the motor? How much is applied to the road? And where and how do losses occur between tank and road? The writer might have strung this information into a series of dry paragraphs; instead, he pictures a river of energy and shows the by-channels that divert portions of this energy into the cooling and exhaust systems, the motor friction, the transmission, tires, and wheels until the power of the car stands at but 12.5 per cent. This is but a solitary instance of the way in which interesting information is continually being put before the eye of the reader; it makes the mastery of facts ridiculously easy, and what the eye thus absorbs is retained in the memory after pages of cold type are forgotten. By such means a man ignorant of mechanics is enabled to pass on to accepted types and typical mechanisms, and to grasp principles of operation with a facility that will surprise no one more than the student himself. The automobile is the flying carpet of today; it has the advantage of the giant locomotive in that it chooses its own road, and it may easily exceed the locomotive in speed, reliability and radius of travel; a device that thus extends the horizon of life is worthy of the owner's best study and care, and quickly responds to this care by returning the investment a hundredfold in time saved, in business transacted, and in pleasure experienced. Lieut. Pagé's work offers the best possible means of acquiring the knowledge that means economy and comfort to the owners and drivers of pleasure cars and commercial vehicles. Every part and construction of the car, the engine, the ignition, lubrication and cooling systems, the starting and lighting installments, and the equipment and accessories, are clearly, comprehensively dealt with; among the latest developments we note high speed aluminum motors and multiple valve and sleeve-valve engines; there is some excellent advice on the driving and care of the car, and even the upkeep of chassis, body and upholstery is not overlooked. The work is in every way beyond comparison with the ordinary manual, and is enthusiastically endorsed by the leading automobile and scientific publications and by all the well-known automobile schools.

TRANSMISSION GEARS. Mechanical, Electric and Hydraulic, for Land and Marine Purposes. By Edward Butler, M.I. Mech.E. Philadelphia: J. B. Lippincott Company, 1917. 8vo.; 176 pp.; 116 figures and 9 folding plates.

Engineers, designers, and all who are interested in the application of the gas engine to general purposes, will here find such important subjects as friction-clutches, change-speed gears and reversing methods treated in a more thorough and comprehensive manner than has hitherto been attempted. Prime movers are widely dependent upon some form of transmission gear; the automobile engineer in particular appreciates the difficulties attending the simplification of transmission, so as not to make too great a demand upon the dexterity of the motorist. The writer points out ways of avoiding some of the inherent faults of "step-by-step" gears, explains the relative adaptability of gradually variable transmissions, both hydraulic and electric, and discusses the uses of compressed air.

UNITED STATES OFFICERS' UNIFORMS. Army, Navy, Marine Corps. By Chas. G. Volk. New York: The International Tailor, 1917. 4vo.; 56 pp.; illustrated.

American tailors will appreciate and profit by the hitherto unpublished information contained in this style book; it is so complete that tailors and cutters may with its aid outfit officers in any branch of the service. The methods of the best uniform tailors are followed, and the system is developed on the simplest lines. While the material of the work conforms to the latest regulations, these regulations leave to the discretion and taste of officers and tailors certain refinements of cuts, seams, and finishes; here again the book will be helpful. The plates are well-drawn, the cutting diagrams large and clear, and there is a detailed index.

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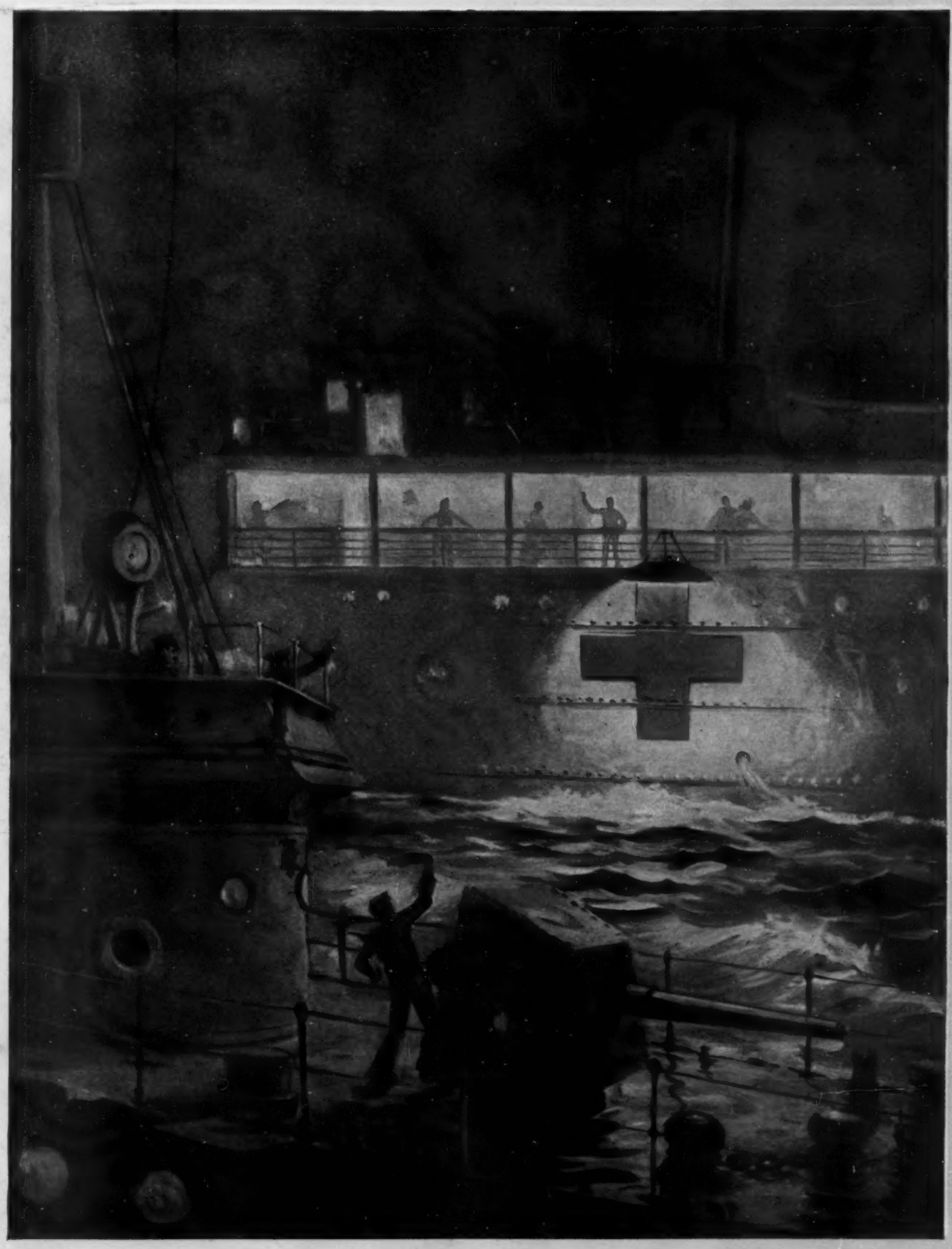

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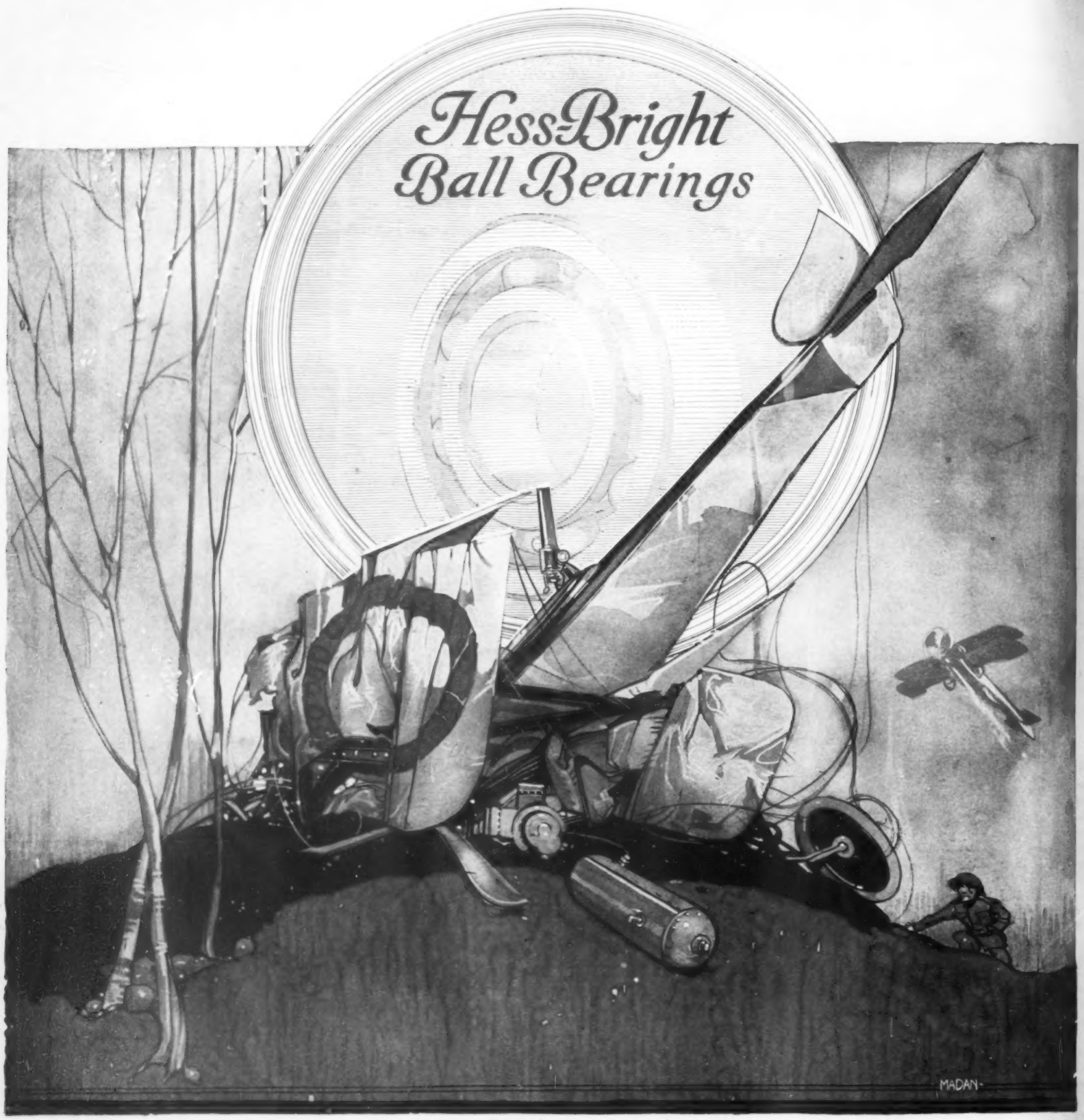

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